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TITLE: FLAME-RETARDANT, VINYL
CHLORIDE-BASED RESIN MOLDED
PRODUCT

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ABSTRACT:

PROBLEM TO BE SOLVED: To provide a flame-retardant, vinyl chloride-based resin molded product excellent in flame retardancy, generating a small amount of smoke and gases, good in chemical resistance and corrosion resistance.

SOLUTION: The flame-retardant, vinyl chloride-based

resin molded product
comprises a vinyl chloride-based resin and, incorporated
thereinto, at least
one of blowing agents, decomposition accelerators, radical
initiators and
crosslinking agents, as a flame retardancy-imparting
component in a specific
ratio, or a combination of a titanium compound and the
flame-retardancy-
imparting component. In the case of a transparent molded
product, the flame
retardancy-imparting agent, a phosphor-containing
flame-retardant or a zinc
compound, or a combination thereof is incorporated.

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CLAIMS

[Claim(s)]

[Claim 1] The fire-resistant vinyl chloride system resin Plastic solid characterized by the thing of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section.

[Claim 2] The fire-resistant vinyl chloride system resin Plastic solid characterized for a foaming agent by the thing of 0.0005 - 10 weight section, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section.

[Claim 3] It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum It is the layer of a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section. A surface layer A foaming agent to the vinyl chloride system resin 100 weight section [whether 0-10 weight section content is carried out and] Or the fire-resistant vinyl chloride system resin Plastic solid characterized by being the layer of 0 - 10 weight section, a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least about a foaming agent.

[Claim 4] It is the fire-resistant vinyl chloride system resin Plastic solid with which it is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum, and whenever [chlorination] is the layer of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least to less than 58% of vinyl chloride system resin 100 weight section as for a substratum, and a surface layer is characterized by whenever [chlorination] being the layer of 58% or more of vinyl chloride system resin.

[Claim 5] The fire-resistant vinyl chloride system resin Plastic solid characterized for a titanium compound by the thing of 5 - 50 weight section, a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section.

[Claim 6] Furthermore, a fire-resistant vinyl chloride system resin Plastic solid given in a chlorine capture compound, claim 1 characterized by the thing of a minerals assistant done for the 2-30 weight section content of any one sort at least, claim 2, or claim 5.

[Claim 7] It is the fire-resistant vinyl chloride system resin Plastic solid characterized by being the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum, for a substratum being a layer which carries out 5-50 weight section content of the titanium compound to the vinyl chloride system resin 100 weight section, and a surface layer being a layer which carries out 0.0005-10 weight section content of 0 - 30 weight section and the foaming agent for a titanium compound to the vinyl chloride system resin 100 weight section.

[Claim 8] It is the Plastic solid which carried out the laminating unification of the surface layer at least

at one side of a substratum. A substratum As opposed to the vinyl chloride system resin 100 weight section a titanium compound 5 - 50 weight section, It is the layer of a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least. A surface layer The fire-resistant vinyl chloride system resin Plastic solid characterized by being the layer which carries out 0.0005-10 weight section content of 0 - 30 weight section and the foaming agent for a titanium compound to the vinyl chloride system resin 100 weight section.

[Claim 9] The fire-resistant vinyl chloride system resin Plastic solid according to claim 5 to 8 characterized by a titanium compound being titanium oxide or potassium titanate.

[Claim 10] The fire-resistant vinyl chloride system resin Plastic solid characterized by carrying out 5-50 weight section content of the potassium titanate to the vinyl chloride system resin 100 weight section.

[Claim 11] The transparent fire-resistant vinyl chloride system resin Plastic solid characterized by for the total light transmission which 0.5 - 15 weight section is carried out for the Lynn system flame retarder, and carries out 0.5-7 weight section content of 0.5 - 20 weight section and the tin system stabilizer for chlorinated polyethylene being 50% or more, and the Hayes value being 60% or less to the vinyl chloride system resin 100 weight section whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation.

[Claim 12] The transparent fire-resistant vinyl chloride system resin Plastic solid characterized by for the total light transmission which the zinc compound was converted [light transmission] into the amount of metal zinc, and carries out 0.5-7 weight section content of 0.005 - 5 weight section and the tin system stabilizer to the vinyl chloride system resin 100 weight section being 40% or more, and the Hayes value being 60% or less.

[Claim 13] The transparent fire-resistant vinyl chloride system resin Plastic solid according to claim 12 whenever [chlorination / of vinyl chloride system resin / whose] is 56% of abbreviation.

[Claim 14] Furthermore, the transparent fire-resistant vinyl chloride system resin Plastic solid according to claim 11 to 13 characterized by the thing of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least.

[Claim 15] The transparent fire-resistant vinyl chloride system resin Plastic solid characterized by for the total light transmission of 0.5 - 7 weight section, a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least being 40% or more, and the Hayes value being 60% or less about 0.5 - 15 weight section and a tin system stabilizer in the Lynn system flame retarder or chlorinated polyethylene to the vinyl chloride system resin 100 weight section whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the vinyl chloride system resin Plastic solid which has the outstanding fire retardancy.

[0002]

[Description of the Prior Art] A moldability is good, the mechanical strength of vinyl chloride resin is high, and it is cheap, since chemical resistance is also good, begins semiconductor fabrication machines and equipment as an industrial use ingredient, especially an anticorrosion industrial use ingredient, and is widely used for all fields.

[0003] In order to pyrolyze if a fire breaks out and to take out smoke and corrosive gas so much, although it has a certain amount of fire retardancy since this vinyl chloride resin contains chlorine, when the Plastic solid of this vinyl chloride resin was used for semiconductor fabrication machines and equipment etc., there was a possibility that the air in a manufacture facility might be polluted for dirt, manufacturing installations, an equipment, semi-conductor components, etc. by the smoke and corrosive gas which occur in case of a fire, or it might be invaded. The Plastic solid of the vinyl chloride resin which has still higher fire retardancy from such a situation comes to be required, and research of the vinyl-chloride-resin Plastic solid with which are satisfied of this demand is done.

[0004] In order to have raised the fire retardancy of a vinyl-chloride-resin Plastic solid, a lot of inorganic fillers were made to contain from the former, or the means of making the flame retarder of a halogen system contain etc. was mainly adopted, but when such a means was adopted, there was a problem which is described below.

[0005]

[Problem(s) to be Solved by the Invention] That is, when making an inorganic filler contain so much, it cannot become difficult to acquire the Plastic solid which a vinyl-chloride-resin Plastic solid carries out embrittlement, and has practical strength, and a transparent Plastic solid cannot be acquired upwards, either, and there was a problem that the chemical resistance and the corrosion resistance of a Plastic solid fell.

[0006] On the other hand, although the fire retardancy of a Plastic solid could be raised, when there is a problem of generating the corrosive gas containing a halogen so much, in case of a fire and the transparent Plastic solid was made to contain a halogen system flame retarder when making the flame retarder of a halogen system contain, there was a problem that transparency fell sharply.

[0007] This invention aims at offer of the outstanding fire-resistant vinyl chloride system resin Plastic solid which can solve these problems.

[0008]

[Means for Solving the Problem] In order to attain said purpose, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 1 of this invention is characterized by the thing of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section.

[0009] The reason whose fire retardancy will improve if vinyl chloride system resin is made to contain the above-mentioned foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent is considered as follows.

[0010] If too much heat joins a vinyl chloride system resin Plastic solid from the outside, while the chlorine in vinyl chloride system resin will break away with heat and will generally demonstrate a fire-resistant operation, the resin from which chlorine seceded pyrolyzes and it results in combustion. In the process in which it results in this combustion, if the foaming agent contains in the Plastic solid If the operation this whose foaming agent foams by the pyrolysis and intercepts the heat from the outside is carried out and the decomposition accelerator contains If the operation this whose decomposition accelerator promotes disassembly of vinyl chloride system resin, and brings carbonization forward is carried out and the radical generating agent contains If the operation whose radical to generate promotes disassembly of vinyl chloride system resin, and brings carbonization forward is carried out and the cross linking agent contains In order to carry out the operation which controls gasification when this cross linking agent reacts with the polymer molecule of vinyl chloride system resin and carries out giant-molecule quantification, it is thought that the fire retardancy of a vinyl chloride system resin Plastic solid improves.

[0011] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 2 of this invention is characterized for a foaming agent by the thing of 0.0005 - 10 weight section, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section.

[0012] The foaming agent is more effective than other decomposition accelerators, a radical generating agent, and a cross linking agent, when controlling early combustion, in order to intercept the heat from the outside by foaming in the phase in early stages of the process in which it results in combustion. Therefore, the fire retardancy which was excellent in the thing which used the foaming agent as the indispensable component like this vinyl chloride system resin Plastic solid, and was made to contain combining this foaming agent, other decomposition accelerators, a radical generating agent, or a cross linking agent after that with the synergism of a heat cutoff operation of a foaming agent and the operation which the decomposition accelerator, the radical generating agent, or the cross linking agent mentioned above while early combustion was enough controlled by the heat cutoff operation of a foaming agent is demonstrated.

[0013] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 3 of this invention It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum It is the layer of a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section. A surface layer To the vinyl chloride system resin 100 weight section, 0-10 weight section content of the foaming agent is carried out, or it is characterized by being the layer of 0 - 10 weight section, a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least about a foaming agent.

[0014] The fire retardancy which a foaming agent was independent at a surface layer, or is excellent in such a Plastic solid after that by the synergism of a heat cutoff operation of a foaming agent and the operation which the decomposition accelerator contained in a surface layer or a substratum, the radical generating agent, or the cross linking agent mentioned above while the combustion depressor effect which was excellent in the first stage with a heat cutoff operation of the foaming agent contained in a surface layer in the early phase result in combustion since it contains combining other decomposition accelerators etc. was demonstrated is demonstrated. Moreover, since the air bubbles produced in disassembly of the foaming agent of a surface layer catch the corrosive gas which occurs in a substratum, the amount's of gas evolutions decrease.

[0015] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 4 of this invention It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum Whenever [chlorination] receives less than 58% of vinyl

*Case less than 58%
the of more than 58%*

chloride system resin 100 weight section. A foaming agent, It is the layer of a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least, and a surface layer is characterized by whenever [chlorination] being the layer of 58% or more of vinyl chloride system resin.

[0016] Whenever [chlorination / of vinyl chloride system resin], and fire retardancy have a forward correlation, and fire retardancy improves, so that whenever [chlorination] becomes high. Therefore, like this Plastic solid, if whenever [chlorination] forms a surface layer by 58% or more and high vinyl chloride system resin, even if it does not make fire-resistant grant components, such as a foaming agent, completely contain, the fire retardancy of a surface layer will improve. Therefore, this Plastic solid demonstrates the fire retardancy in which the substratum was excellent as a whole conjointly with fire retardancy being raised by one content of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent.

[0017] Since all fire-resistant vinyl chloride system resin Plastic solids concerning above claims 1-4 contain an inorganic filler, chemical resistance and corrosion resistance are good, and do not produce a fall on the strength by embrittlement.

[0018] In addition, since it becomes difficult to give sufficient fire retardancy for a Plastic solid when the content of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent is less than the range indicated by claims 1-4 in the Plastic solid of claims 1-4, and the further improvement in the fire retardancy corresponding to it is not found even if it makes it contain so that it may exceed the range indicated by claims 1-4 on the other hand, it becomes a waste of an ingredient.

[0019] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 5 of this invention is characterized for a titanium compound by the thing of 5 - 50 weight section, a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least to the vinyl chloride system resin 100 weight section, and titanium oxide, potassium titanate, etc. which are indicated by claim 9 are used as a titanium compound.

[0020] Since titanium compounds, such as titanium oxide, have very high pyrolysis temperature and the whiteness degree and thermal conductivity are high powder, In the process in which it will result in combustion if such a titanium compound contains to vinyl chloride system resin While serving to intercept the heat from the outside by the high whiteness degree, without this titanium compound decomposing to a 1200-1300-degree C elevated temperature (heat cutoff operation) In the pyrolysis of the resin after chlorine balking, and the phase of combustion, it serves to carbonize this resin more quickly with high thermal conductivity (carbonization promotion operation). And when the foaming agent contains with this titanium compound When the fire retardancy which the heat cutoff operation which this foaming agent mentioned above joined the heat cutoff operation of a titanium compound, and was further excellent is demonstrated and the decomposition accelerator and the radical generating agent contain When the fire retardancy which the carbonization promotion operation which this decomposition accelerator and this radical generating agent mentioned above joined the carbonization promotion operation of a titanium compound, and was further excellent is demonstrated and the cross linking agent contains further The fire retardancy which the gasification depressant action, the heat cutoff operation of a titanium compound, and carbonization promotion operation which this cross linking agent mentioned above multiplied, and was further excellent is demonstrated.

[0021] In the Plastic solid of this claim 5, although fire retardancy will improve notably if the content of a titanium compound exceeds 50 weight sections and the content of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent exceeds 10 weight sections, the chemical resistance of a Plastic solid, reinforcement, bending workability, etc. fall. On the other hand, if the content of a titanium compound is less than 5 weight sections and the content of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent is less than the 0.0005 weight section, a heat cutoff operation and carbonization promotion acting will become inadequate, and it will become difficult to raise fire retardancy.

[0022] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 6 of this invention is further characterized by the thing of a chlorine capture compound and a minerals assistant done for the 2-30 weight section content of any one sort at least in the Plastic solid of above-mentioned claim 1, claim 2, or claim 5.

[0023] Since chlorine is captured with a chlorine capture compound at the time of combustion when a chlorine capture compound is included, when the yield of corrosive gas, such as chlorine gas and hydrogen chloride gas, decreases further and a minerals assistant is included, in order that a titanium compound and a minerals assistant may multiply this Plastic solid and it may promote carbonization of vinyl chloride system resin further, volume of smoke outbreak decreases further and its fire retardancy improves further.

[0024] When there are few contents of a chlorine capture compound or a minerals assistant than 2 weight sections, the yield of corrosive gas or smoke seldom decreases, but the further fire-resistant improvement also becomes difficult. On the other hand, when a content exceeds 30 weight sections, the chemical resistance of a Plastic solid, reinforcement, bending workability, a moldability, etc. fall.

[0025] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 7 of this invention It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum To the vinyl chloride system resin 100 weight section, it is the layer which carries out 5-50 weight section content of the titanium compound, and a surface layer is characterized by being the layer which carries out 0.0005-10 weight section content of 0 - 30 weight section and the foaming agent for a titanium compound to the vinyl chloride system resin 100 weight section. TiO₂ content

[0026] Below 30 weight sections, since there are few contents of the titanium compound of a surface layer, this Plastic solid The front face of a Plastic solid has the good chemical resistance and the good corrosion resistance of vinyl chloride system resin original. And since 5-50 weight section content of the titanium compound which demonstrates a heat cutoff operation and a carbonization promotion operation to the substratum of this Plastic solid is carried out and 0.0005-10 weight section content of the foaming agent which demonstrates a heat cutoff operation to a surface layer is carried out, this Plastic solid has the fire retardancy which was excellent as a whole. And since the corrosive gas which the air bubbles produced in disassembly of the foaming agent of a surface layer generate in a substratum is caught, the amount of gas evolutions also decreases.

[0027] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 8 of this invention It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum As opposed to the vinyl chloride system resin 100 weight section a titanium compound 5 - 50 weight section, It is the layer of a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least. A surface layer It is characterized by being the layer which carries out 0.0005-10 weight section content of 0 - 30 weight section and the foaming agent for a titanium compound to the vinyl chloride system resin 100 weight section.

[0028] Since this Plastic solid also has few contents of the titanium compound of a surface layer as [below] 30 weight sections, the front face of a Plastic solid has the good chemical resistance and the good corrosion resistance of vinyl chloride system resin original. And with the titanium compound which demonstrates a heat cutoff operation and a carbonization promotion operation, since the decomposition accelerator and radical generating agent which demonstrate a carbonization promotion operation, and the cross linking agent contain the substratum, it is excellent in fire retardancy, catches the corrosive gas which occurs in this substratum by the air bubbles produced by disassembly of the foaming agent of a surface layer, and controls the amount of gas evolutions. Therefore, this Plastic solid has the fire retardancy which was excellent as a whole.

[0029] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 10 of this invention is characterized by carrying out 5-50 weight section content of the potassium titanate to the vinyl chloride system resin 100 weight section.

[0030] Also in carrying out 5-50 weight section content of the potassium titanate which is a titanium

compound like this Plastic solid, in order that potassium titanate may demonstrate a heat cutoff operation and a carbonization promotion operation in case of a fire, fire retardancy improves and the yield of smoke or corrosive gas decreases.

[0031] Next, the transparent fire-resistant vinyl chloride system resin Plastic solid concerning claim 11 of this invention is characterized by for the total light transmission which 0.5 - 15 weight section is carried out for the Lynn system flame retarder, and carries out 0.5-7 weight section content of 0.5 - 20 weight section and the tin system stabilizer for chlorinated polyethylene being 50% or more, and the Hayes value being 60% or less of Plastic solid to the vinyl chloride system resin 100 weight section whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation.

[0032] According to this fire-resistant vinyl chloride system resin Plastic solid, the operation which the Lynn system flame retarder oxidizes thru/or pyrolyzes at the time of combustion, and generates a phosphoric acid, promotes surface carbonization while this phosphoric acid remains on the front face of vinyl chloride system resin and bars oxygen transfer, and controls combustion is demonstrated. And the operation which generates chlorine gas by the pyrolysis and delays combustion is carried out, the high vinyl chloride system resin of whenever [chlorination] also generates a lot of chlorine gas by the pyrolysis, and chlorinated polyethylene delays combustion. Therefore, this vinyl chloride system resin Plastic solid is excellent in fire retardancy, and there is little volume of smoke outbreak.

[0033] Moreover, if the Lynn system flame retarder is made to contain like this vinyl chloride system resin Plastic solid, transparency will improve compared with the case where a halogen system flame retarder is made to contain, and the Plastic solid which has 50% or more of total light transmission and 60% or less of Hayes value as mentioned above will be acquired. In order that a tin system stabilizer may acquire a transparent vinyl chloride system resin Plastic solid, it is an indispensable thermostabilizer, and even if it adds a lead system stabilizer, it is difficult to acquire a transparent Plastic solid. In addition, above-mentioned total light transmission and the above-mentioned Hayes value are a value in case the thickness of a Plastic solid is 5mm.

[0034] If the content of the Lynn system flame retarder and chlorinated polyethylene becomes less than the 0.5 weight section to the vinyl chloride system resin 100 weight section, respectively, it will become difficult to give sufficient fire retardancy for a Plastic solid. On the other hand, if the content of the Lynn system flame retarder increases more than 15 weight sections, this flame retarder will come to carry out bleed out, and if the content of chlorinated polyethylene increases more than 20 weight sections, transparency will fall. Furthermore, it becomes disadvantageous, when raising fire retardancy, if vinyl chloride system resin with whenever [chlorination / lower than 58%] is used, and since the vinyl chloride system resin with whenever [chlorination / higher than 73%] has thermal stability, a moldability, chemical resistance, bad corrosion resistance, etc., it is unsuitable.

[0035] Next, the transparent fire-resistant vinyl chloride system resin Plastic solid concerning claim 12 of this invention is characterized by for the total light transmission which the zinc compound was converted [light transmission] into the amount of metal zinc, and carries out 0.5-7 weight section content of 0.005 - 5 weight section and the tin system stabilizer being 40% or more, and the Hayes value being 60% or less of Plastic solid to the transparent vinyl chloride system resin 100 weight section.

[0036] If a zinc compound is made to contain like this Plastic solid, since carbonization of vinyl chloride resin will be promoted by pitch solution promotion operation of a zinc compound at the time of combustion, fire retardancy improves. If it becomes difficult to give sufficient fire retardancy for a Plastic solid if the content of a zinc compound converts into the amount of metal zinc and becomes less than the 0.005 weight section and it increases more than 5 weight sections on the other hand, transparency will worsen. In addition, above-mentioned total light transmission and the above-mentioned Hayes value are a value in case the thickness of a Plastic solid is 5mm.

[0037] Next, the transparent fire-resistant vinyl chloride system resin Plastic solid concerning claim 13 of this invention is characterized by whenever [chlorination / of vinyl chloride system resin] being 56% of abbreviation in the Plastic solid of above-mentioned claim 12.

[0038] If the vinyl chloride system resin whenever [chlorination / whose] is 56% of abbreviation is used like this Plastic solid, chemical resistance is good and can consider as the Plastic solid which has

fire retardancy.

[0039] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 14 of this invention is further characterized by the thing of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent done for the 0.0005-10 weight section content of any one sort at least in the Plastic solid of either above-mentioned claim 11 thru/or claim 13.

[0040] Fire retardancy is further raised by the heat cutoff operation whose foaming agent mentioned such a Plastic solid above, the carbonization promotion operation which the decomposition accelerator and the radical generating agent mentioned above, and the gasification depressant action which the cross linking agent mentioned above. If these contents become less than the 0.0005 weight section, it becomes difficult to raise fire retardancy further, and since the fire-resistant disposition top effectiveness of having balanced it is not acquired even if it makes a large quantity contain from 10 weight sections, on the other hand, it will become useless.

[0041] Next, the fire-resistant vinyl chloride system resin Plastic solid concerning claim 15 of this invention As opposed to the vinyl chloride system resin 100 weight section whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation 0.5 - 15 weight section and a tin system stabilizer for the Lynn system flame retarder or chlorinated polyethylene 0.5 - 7 weight section, It is characterized by for the total light transmission of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least being 40% or more, and the Hayes value being 60% or less of Plastic solid.

[0042] Since the fire retardancy of a Plastic solid is raised by the fire-resistant grant component when blending fire-resistant grant components, such as a foaming agent, like this Plastic solid, it becomes unnecessary to make the both sides of the Lynn system flame retarder and chlorinated polyethylene contain like the Plastic solid of said claim 11, one of the Lynn system flame retarder and chlorinated polyethylene is made to only contain, and it becomes possible to give the outstanding fire retardancy. In addition, an operation of the Lynn system flame retarder blended with this Plastic solid, chlorinated polyethylene, a tin system stabilizer, etc. is as by the way the Plastic solid of said claim 11 having explained.

[0043]

[Embodiment of the Invention] Hereafter, the concrete operation gestalt of this invention is explained in full detail.

[0044] The fire-resistant vinyl chloride system resin Plastic solid of this invention ** foaming agent, a decomposition accelerator, A radical generating agent or a cross linking agent (these are hereafter called fire-resistant grant component collectively) is included. Plastic solid B containing either and the titanium compound of Plastic solid A which contains neither a titanium compound nor the Lynn system flame retarder nor a zinc compound, and ** fire retardancy grant component ** It is divided roughly into transparent Plastic solid D which contains either of the fire-resistant grant components as preferably as Plastic solid C, ** Lynn system flame retarder, the zinc compound, or chlorinated polyethylene which does not contain a fire-resistant grant component including a titanium compound.

[0045] As main operation gestalten of Plastic solid A, they are Plastic solid A1 of the monolayer structure described below, A2, A3, A4, and A5. Plastic solid A6 of double layer structure, and A7 It is mentioned.

[0046] Plastic solid A1 the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of the foaming agent among fire-resistant grant components to the vinyl chloride system resin 100 weight section -- it is -- this Plastic solid A1 **** -- optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out. The stabilizer of a lead system is used when acquiring an opaque Plastic solid, and the stabilizer of a tin system is used when acquiring a transparent Plastic solid.

[0047] the common vinyl chloride resin whenever [(a) chlorination / whose] is about 56% as vinyl chloride system resin, the back chlorinated polyvinyl chloride resin whenever [(b) chlorination / whose] are abbreviation 58 - 73% of abbreviation, and (c) -- copolymerization resin with the resin which mixed these vinyl chloride resin, the resin which mixed vinyl acetate resin, acrylic resin, etc. and

A6 = A7

(d) (e) vinyl chloride, vinyl acetate, ethylene, etc. is used for these vinyl chloride resin.

[0048] The common vinyl chloride resin of (a) is Plastic solid A1 excellent in chemical resistance.

Especially when obtaining, are effective. The back chlorinated polyvinyl chloride resin of (b) is Plastic solid A1 excellent in fire retardancy. Especially when obtaining, are effective. The mixed resin of (c) is Plastic solid A1 with chemical-resistant and fire-resistant sufficient balance. It is Plastic solid A1 with which it is effective with the Plastic solid especially when obtaining, and the mixed resin of (d) and the copolymerization resin of (e) have improved physical properties, such as a moldability and bending workability. It is effective especially when obtaining. It is necessary to make it the resin of (c), (d), and (e) maintain fire retardancy by mixing or carrying out copolymerization of whenever [average chlorination] so that it may become about 50 - 73% of abbreviation.

[0049] As a foaming agent contained to this vinyl chloride system resin, what starts foaming is suitable at the temperature of 200 degrees C or more higher than the fabrication temperature of vinyl chloride system resin, for example, an AZOJI carvone amide, azobisisobutyronitril, dinitrosopentamethylenetetramine, a hydrazide compound, the mixture of inorganic carbonates (for example, PARATORU en sulfonylhydrazide, 4, and 4'-oxybis benzene sulfonylhydrazide etc.) and an organic acid, etc. are used preferably.

[0050] Plastic solid A1 of the monolayer structure where vinyl chloride system resin was made to contain such a foaming agent If it does not foam at the time of shaping and bending and is heated beyond foaming temperature in case of a fire, in order to demonstrate the heat cutoff operation which the foaming agent foamed and was excellent, it is Plastic solid A1. Fire retardancy improves sharply. And since smoke and corrosive gas are incorporated in air bubbles, volume of smoke outbreak and a corrosive gas yield can also be decreased.

[0051] Since the fire retardancy disposition top effectiveness which balanced it even if it becomes difficult to give sufficient fire retardancy for a Plastic solid since it is required to make the content of a foaming agent into 0.0005 - 10 weight section to the vinyl chloride system resin 100 weight section and heat cutoff operations run short under in the 0.0005 weight sections and it made the large quantity contain from 10 weight sections on the other hand is not seen, it becomes a waste of a foaming agent. The still more desirable content of a foaming agent is 0.05 - 5 weight section.

[0052] This Plastic solid A1 In addition to having the fire retardancy which was excellent as mentioned above, since an inorganic filler is not included, chemical resistance and corrosion resistance are good, and reinforcement does not fall by embrittlement.

[0053] Next, Plastic solid A2 To the vinyl chloride system resin 100 weight section, it is the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of the decomposition accelerator among fire-resistant grant components, and is this Plastic solid A2. Optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0054] As a decomposition accelerator, what promotes disassembly of vinyl chloride system resin is suitable at the temperature of 200 degrees C or more higher than the fabrication temperature of vinyl chloride system resin, and a zinc compound (for example, zinc soap, such as lauric-acid zinc, zinc stearate, and zinc benzoate), amine compounds (for example, a melamine, triethylamine, etc.), an iron hydroxide, etc. are preferably used also in it. In addition, vinyl chloride system resin is above-mentioned Plastic solid A1. The same thing as what was used is used.

[0055] Plastic solid A2 which made vinyl chloride system resin contain such a decomposition accelerator Although vinyl chloride system resin is not decomposed by the decomposition accelerator at the time of shaping and bending, since disassembly of vinyl chloride system resin is promoted with a decomposition accelerator and carbonization is brought forward, the outstanding fire retardancy can be demonstrated in the process in which it results in the combustion in case of a fire.

[0056] Since the fire retardancy disposition top effectiveness which balanced it even if it becomes difficult to give sufficient fire retardancy for a Plastic solid since it is required to make the content of a decomposition accelerator into 0.0005 - 10 weight section to the vinyl chloride system resin 100 weight section and carbonization promotion operations run short under in the 0.0005 weight sections and it

made the large quantity contain from 10 weight sections on the other hand is not seen, it becomes a waste of a decomposition accelerator. The still more desirable content of a decomposition accelerator is 0.05 - 5 weight section.

[0057] Next, Plastic solid A3 To the vinyl chloride system resin 100 weight section, it is the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of the radical generating agent among fire-resistant grant components, and is this Plastic solid A3. Optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0058] As a radical generating agent, what generates a radical is suitable at the temperature of 200 degrees C or more higher than the fabrication temperature of vinyl chloride system resin, for example, peroxides, such as JIAMIRO peroxide, peroxy dicarbonate, dialkyl peroxide, and hydroperoxide, a perchlorate, etc. are used preferably. In addition, vinyl chloride system resin is above-mentioned Plastic solid A1. The same thing as what was used is used.

[0059] Plastic solid A3 which made vinyl chloride system resin contain the radical generating agent which acts at an elevated temperature as mentioned above Since a radical does not occur at the time of shaping and processing, there is no fear of degradation, but in the process in which it results in the combustion in case of a fire, since the radical generated by the radical generating agent promotes disassembly of vinyl chloride system resin and brings carbonization forward, the outstanding fire retardancy can be demonstrated.

[0060] Since the fire retardancy disposition top effectiveness which balanced it even if it becomes difficult to give sufficient fire retardancy for a Plastic solid since it is required to make the content of a radical generating agent into 0.0005 - 10 weight section to the vinyl chloride system resin 100 weight section and carbonization promotion operations run short under in the 0.0005 weight sections and it made the large quantity contain from 10 weight sections on the other hand is not seen, it becomes a waste of a radical generating agent. The still more desirable content of a radical generating agent is 0.05 - 5 weight section.

[0061] Next, Plastic solid A4 To the vinyl chloride system resin 100 weight section, it is the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of the cross linking agent among fire-resistant grant components, and is this Plastic solid A4. Optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0062] As a cross linking agent, what starts bridge formation is suitable at the temperature of 200 degrees C or more higher than the fabrication temperature of vinyl chloride system resin, for example, triazine thiol compounds etc. are used preferably. In addition, vinyl chloride system resin is above-mentioned Plastic solid A1. The same thing as what was used is used.

[0063] thus -- since crosslinking reaction does not produce Plastic solid A4 which made vinyl chloride system resin contain the cross linking agent which acts at an elevated temperature at the time of shaping and processing -- various configurations -- shaping -- or fabricating can be carried out. And in the process in which it results in the combustion in case of a fire, since it is hard coming to gasify while macromolecule quantification of the polymer molecule of vinyl chloride system resin is carried out by crosslinking reaction and thermal resistance is raised, the outstanding fire retardancy is demonstrated.

[0064] Since the fire retardancy disposition top effectiveness which balanced it even if it becomes difficult to give sufficient fire retardancy for a Plastic solid since it is required to make the content of a cross linking agent into 0.0005 - 10 weight section to the vinyl chloride system resin 100 weight section and macromolecule quantification and gasification depressant action runs short under in the 0.0005 weight sections and it made the large quantity contain from 10 weight sections on the other hand is not seen, it becomes a waste of a cross linking agent. The still more desirable content of a cross linking agent is 0.05 - 5 weight section.

[0065] Above-mentioned Plastic solid A1 - A4 Although any one sort of the fire-resistant grant component is made to contain to vinyl chloride system resin, any two or more sorts of the fire-resistant grant component may be made to contain. In that case, Plastic solid A5 described below It is desirable to

use a foaming agent as an indispensable component like, and to make it contain combining this foaming agent and other fire-resistant grant components.

[0066] Namely, Plastic solid A5 To the vinyl chloride system resin 100 weight section, in a foaming agent, it is the Plastic solid of the monolayer structure of 0.0005 - 10 weight section, the decomposition accelerator which are other fire-resistant grant components, a radical generating agent, and a cross linking agent of carrying out 0.0005-10 weight section content of any one sort at least, and optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0067] Vinyl chloride system resin, the foaming agent which is a fire-resistant grant component, a decomposition accelerator, a radical generating agent, and a cross linking agent are above-mentioned Plastic solid A1 - A4. The same thing as what was used is used.

[0068] When controlling early combustion, the foaming agent is more effective than other fire-resistant grant components, in order to intercept the heat from the outside by foaming in the phase in early stages of the process in which it results in combustion. Therefore, above-mentioned Plastic solid A5 which made this foaming agent indispensable and was made to contain more than combining a kind of other fire-resistant grant components While early combustion is enough controlled by heat cutoff operation of a foaming agent, the outstanding fire retardancy is demonstrated after that according to the synergism of a heat cutoff operation of a foaming agent, and the carbonization promotion operation and gasification depressant action which other fire-resistant grant components mentioned above. And since the air bubbles produced in disassembly of a foaming agent catch the occurring smoke and corrosive gas, the amount's [volume of smoke outbreak or] of gas evolutions decrease.

[0069] Since the fire-resistant disposition top effectiveness of having balanced it will not be acquired even if it becomes difficult to give sufficient fire retardancy and it makes [more] it conversely than this if it is required to consider as 0.0005 - 10 weight section and it makes it fewer than this, the content of a foaming agent and the content of other fire-resistant grant components serve as a waste of a fire-resistant grant component. The still more desirable content of a foaming agent and other fire-resistant grant components is 0.05 - 5 weight section.

[0070] Fire-resistant vinyl chloride system resin Plastic solid A1 of monolayer structure explained above - A5 The vinyl chloride system resin constituent which chose and blended the fire-resistant grant component and the additive is fabricated in the configuration of requests, such as a plate, a pipe, the round bar, an angle type, and other section shapes, with extrusion molding, a calender press, injection molding, and other well-known forming technique, and it is obtained. Such a Plastic solid is used for remaining as it is or the various applications as which fabricating is further carried out and fire retardancy is required.

[0071] Next, Plastic solid A6 of double layer structure It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum As opposed to the vinyl chloride system resin 100 weight section among fire-resistant grant components A decomposition accelerator, It is the layer of a radical generating agent and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least. A surface layer A foaming agent to the vinyl chloride system resin 100 weight section [whether 0-10 weight section content is carried out and] Or it becomes 0 - 10 weight section from the layer of the decomposition accelerator which are other fire-resistant grant components, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least about a foaming agent. This Plastic solid A6 Optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out also at a substratum or a surface layer.

[0072] Moreover, vinyl chloride system resin, the foaming agent which is a fire-resistant grant component, a decomposition accelerator, a radical generating agent, and a cross linking agent are above-mentioned Plastic solid A1 - A4. The same thing as what was used is used.

[0073] Plastic solid A6 of such double layer structure While the combustion depressor effect which was excellent in the first stage in the early phase of resulting in combustion with a heat cutoff operation of

the foaming agent contained in a surface layer is demonstrated, the outstanding fire retardancy is demonstrated after that according to the synergism of a heat cutoff operation of a foaming agent, and the carbonization promotion operation and gasification depressant action of other fire-resistant grant components which are included in a surface layer or a substratum. And since the air bubbles produced in disassembly of the foaming agent of a surface layer catch the smoke and corrosive gas which occur in a substratum, the amount's [volume of smoke outbreak or] of gas evolutions decrease.

[0074] The content of the decomposition accelerator which is the fire-resistant grant component of a substratum, a radical generating agent, and a cross linking agent, and the foaming agent of a surface layer and the content of other fire-resistant grant components If to consider as within the limits of the above is required, the content of the fire-resistant grant component of a substratum becomes less than the 0.0005 weight section and the content of the content of 0 weight section and other fire-resistant grant components of the foaming agent of a surface layer becomes less than the 0.0005 weight section It is Plastic solid A6 about sufficient fire retardancy. Giving becomes difficult. Since the fire-resistant disposition top effectiveness of having balanced it is not acquired on the other hand even if the content of the fire-resistant grant component of a substratum exceeds 10 weight sections and the foaming agent of a surface layer and the content of other fire-resistant grant components exceed 10 weight sections, it becomes a waste of a fire-resistant grant component. The still more desirable content of the fire-resistant grant component in a substratum is 0.05 - 5 weight section, and the still more desirable contents of the foaming agent in a surface layer and other fire-resistant grant components are 0 - 5 weight section and 0.05 - 5 weight section.

[0075] Plastic solid A7 of another double layer structure As opposed to the vinyl chloride system resin 100 weight section in which the substratum has whenever [chlorination / less than 58% of] It is the layer of a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent which carries out 0.0005-10 weight section content of any one sort at least, and the surface layer which carried out laminating unification becomes at least one side of this substratum from the layer of the vinyl chloride system resin which has whenever [chlorination / 58% or more of]. This Plastic solid A7 Optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out also at a substratum or a surface layer.

[0076] The common vinyl chloride resin whenever [chlorination / which was mentioned above / whose] is about 56% as vinyl chloride system resin of a substratum is used suitably. And the back chlorinated polyvinyl chloride resin whenever [chlorination / which was mentioned above / whose] are abbreviation 58 - 73% of abbreviation as vinyl chloride system resin of a surface layer is used suitably, and 58% or more of mixed resin is also used for whenever [average chlorination / which mixed common vinyl chloride resin, vinyl acetate resin, acrylic resin, vinyl chloride-vinyl acetate copolymerization resin, etc. to chlorinated polyvinyl chloride resin further after this]. Moreover, a foaming agent, a decomposition accelerator, a radical generating agent, and a cross linking agent are above-mentioned Plastic solid A2 - A4. The same thing as what was used is used.

[0077] Whenever [chlorination / of vinyl chloride system resin], and fire retardancy have a forward correlation, and if whenever [chlorination] forms a surface layer by 58% or more and high vinyl chloride system resin as mentioned above in order to improve, even if fire retardancy does not make fire-resistant grant components, such as a foaming agent, completely contain, its fire retardancy of a surface layer will improve, so that whenever [chlorination] becomes high. Therefore, Plastic solid A7 of this double layer structure A substratum is made to only contain a foaming agent, a decomposition accelerator, a radical generating agent, or a cross linking agent, and the fire retardancy which was excellent as a whole can be given.

[0078] If the content of the foaming agent which is the fire-resistant grant component of a substratum, a decomposition accelerator, a radical generating agent, and a cross linking agent needs to consider as 0.0005 - 10 weight section and it becomes less than the 0.0005 weight sections, it will become difficult to give sufficient fire retardancy, and on the other hand, since the fire-resistant disposition top effectiveness of having balanced it is not acquired even if it makes a large quantity contain from 10

weight sections, it becomes a waste of a fire-resistant grant component. The still more desirable content of the fire-resistant grant component in a substratum is 0.05 - 5 weight section.

[0079] Plastic solid A6 of the above-mentioned double layer structure, and A7 The vinyl chloride system resin constituent for substratum formation which chose and blended a fire-resistant grant component and other additives, The vinyl chloride system resin constituent for surface layer formation which chose and blended a fire-resistant grant component and other additives, Or the vinyl chloride system resin constituent for surface layer formation which does not contain a fire-resistant grant component is prepared. Laminate molding of these constituents is carried out to a desired configuration with the means of multilayer extrusion shaping, a calender press, a lamination, and others, and it is manufactured, and is used for remaining as it is or the various applications as which fabricating is carried out and fire retardancy is required.

[0080] Next, vinyl chloride system resin Plastic solid B which contained the titanium compound as either of the fire-resistant grant components is explained. As main operation gestalten of this Plastic solid B, they are Plastic solid B1 of the monolayer structure described below, B-2, B3, and B4. Plastic solid B5 of double layer structure, and B6 It is mentioned. B5 + B6

[0081] Plastic solid B1 the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of the foaming agent for a titanium compound among 5 - 50 weight section and a fire-resistant grant component to the vinyl-chloride-resin 100 weight section -- it is -- this Plastic solid B1 **** -- optimum dose combination of the various additives, such as a stabilizer of a lead system or a tin system required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0082] As a titanium compound, titanium oxide, potassium titanate, etc. are used and the fine particles which have the mean particle diameter which is about 0.1-0.5 micrometers are used especially preferably. The fine particles of the titanium oxide which has such a mean diameter, or potassium titanate can have good kneading nature with vinyl chloride system resin, and it can make them contain in the state of uniform distribution. Moreover, since smoke and gas have the advantage adsorbed with an alumina while carbonization of vinyl chloride system resin is further promoted by the synergism of titanium oxide and an alumina at the time of combustion, the titanium oxide which covered the front face with the alumina is used very preferably.

[0083] In addition, vinyl chloride system resin and a foaming agent are above-mentioned Plastic solid A1. The same thing as what was used is used.

[0084] This Plastic solid B1 Since the amount of the vinyl chloride system resin which is the organic substance decreases relatively, and a heat cutoff operation and a gas capture operation will be demonstrated also with a foaming agent while a heat cutoff operation and a carbonization promotion operation are demonstrated with a titanium compound in the process in which it results in combustion as mentioned already if the titanium compound and the foaming agent contain like, it is Plastic solid B1. Fire retardancy improves and volume of smoke outbreak and the yield of corrosive gas decrease. Moreover, when what starts foaming at the temperature of 200 degrees C or more higher than fabrication temperature as a foaming agent is used, it cannot foam at the time of shaping, but a hard Plastic solid can be acquired, and there is no fear of foaming also at the time of fabricating, such as bending.

[0085] It is necessary to make the content of a titanium compound into 5 - 50 weight section to the vinyl-chloride-resin 100 weight section, and to make the content of a foaming agent into 0.0005 - 10 weight section. When the content of a titanium compound exceeds 50 weight sections and the content of a foaming agent exceeds 10 weight sections, fire retardancy is Plastic solid B1, although it improves notably. Chemical resistance, reinforcement, bending workability, etc. fall. On the other hand, if the content of a titanium compound is less than 5 weight sections and the content of a foaming agent is less than the 0.0005 weight section, a heat cutoff operation and carbonization promotion acting will become inadequate, and it will become difficult to raise fire retardancy. The still more desirable content of 8 - 30 weight section and a foaming agent of the still more desirable content of a titanium compound is 0.05 - 10 weight section.

[0086] Next, Plastic solid B-2 To the vinyl chloride system resin 100 weight section, it is the Plastic

solid of the monolayer structure of carrying out 0.0005-10 weight section content of 5 - 50 weight section and the decomposition accelerator for a titanium compound, and is this Plastic solid B-2.

Optimum dose combination of the various additives, such as a lead system or a tin system stabilizer required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0087] A titanium compound is above-mentioned Plastic solid B1. The same thing as what was used is used, and vinyl chloride system resin and a decomposition accelerator are above-mentioned Plastic solid A1 and A2. The same thing as what was used is used.

[0088] This Plastic solid B-2 If the titanium compound and the decomposition accelerator contain like, since in addition to fire retardancy improving according to a heat cutoff operation of a titanium compound and a carbonization promotion operation disassembly of vinyl chloride system resin will be promoted with a decomposition accelerator and carbonization will be further brought forward at the time of combustion, the outstanding fire retardancy is demonstrated. Moreover, if what acts at an elevated temperature 200 degrees C or more as a decomposition accelerator is used, disassembly of vinyl chloride system resin with a decomposition accelerator will not arise at the time of fabricating, such as the time of shaping, and bending, but a Plastic solid with reinforcement and a bending object will be acquired.

[0089] The content of a titanium compound is said Plastic solid B1. It is necessary to consider as 5 - 50 weight section to the vinyl-chloride-resin 100 weight section, and to make the content of a decomposition accelerator into 0.0005 - 10 weight section similarly like a case. The reason is said Plastic solid B1. Since it is the same as that of a case, explanation is omitted. In addition, the still more desirable content of 8 - 30 weight section and a decomposition accelerator of the still more desirable content of a titanium compound is 0.0005 - 5 weight section.

[0090] Next, Plastic solid B3 To the vinyl chloride system resin 100 weight section, it is the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of 5 - 50 weight section and the radical generating agent for a titanium compound, and is this Plastic solid B3. Optimum dose combination of the various additives, such as a lead system or a tin system stabilizer required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0091] And a titanium compound is above-mentioned Plastic solid B1. The same thing as what was used is used, and vinyl chloride system resin and a radical generating agent are above-mentioned Plastic solid A1 and A3. The same thing as what was used is used.

[0092] This Plastic solid B3 If a titanium compound and a radical generating agent are made to contain like, since in addition to fire retardancy improving according to a heat cutoff operation of a titanium compound and a carbonization promotion operation a radical will occur, disassembly of vinyl chloride system resin will be promoted by the radical generating agent and carbonization will be further brought forward at the time of combustion, the outstanding fire retardancy is demonstrated. Moreover, if what acts at an elevated temperature 200 degrees C or more as a radical generating agent is used, since a radical will not be generated at the time of shaping and fabricating, there is no degradation of the vinyl chloride system resin at the time of shaping and fabricating, and mold goods and a secondary-forming article with reinforcement can be obtained.

[0093] The content of a titanium compound is said Plastic solid B1. It is necessary to consider as 5 - 50 weight section to the vinyl-chloride-resin 100 weight section, and to make the content of a radical generating agent into 0.0005 - 10 weight section similarly like a case. Since the reason is the same as that of the case of said Plastic solid B1, explanation is omitted. In addition, the still more desirable content of 8 - 30 weight section and a radical generating agent of the still more desirable content of a titanium compound is 0.0005 - 5 weight section.

[0094] Next, Plastic solid B4 To the vinyl chloride system resin 100 weight section, it is the Plastic solid of the monolayer structure of carrying out 0.0005-10 weight section content of 5 - 50 weight section and the cross linking agent for a titanium compound, and is this Plastic solid B4. Optimum dose combination of the various additives, such as a lead system or a tin system stabilizer required for shaping, lubricant, processing aid, and a coloring agent, is carried out.

[0095] And a titanium compound is above-mentioned Plastic solid B1. The same thing as what was used is used, and vinyl chloride system resin and a cross linking agent are above-mentioned Plastic solid A1

and A4. The same thing as what was used is used.

[0096] this Plastic solid B4 if a titanium compound and a cross linking agent are made to contain like, fire retardancy will improve according to a heat cutoff operation of a titanium compound and a carbonization promotion operation -- in addition, macromolecule quantification of the resin is carried out by operation of the heat from the outside, and a cross linking agent, and since it is hard coming to gasify while thermal resistance is raised, the outstanding fire retardancy is demonstrated. Moreover, if what acts at an elevated temperature 200 degrees C or more as a cross linking agent is used, since crosslinking reaction will not be produced at the time of shaping, the Plastic solid acquired has the same good moldability as usual, and can carry out fabricating to various configurations.

[0097] The content of a titanium compound is said Plastic solid B1. It is necessary to consider as 5 - 50 weight section to the vinyl-chloride-resin 100 weight section, and to make the content of a cross linking agent into 0.0005 - 10 weight section similarly like a case. Since the reason is the same as that of the case of said Plastic solid A, explanation is omitted. In addition, the still more desirable content of 8 - 30 weight section and a cross linking agent of the still more desirable content of a titanium compound is 0.05 - 5 weight section.

[0098] Above Plastic solid B1, B-2, B3, and B4 It sets, and even if there are still few chlorine capture compounds or minerals assistants, 2-30 weight section content of any one sort may be carried out. If a chlorine capture compound is made to contain, since chlorine will be captured with a chlorine capture compound at the time of combustion, if the yield of corrosive gas, such as chlorine gas and hydrogen chloride gas, decreases further and a minerals assistant is made to contain, in order for a titanium compound and a minerals assistant to multiply and to promote carbonization of vinyl chloride system resin further, volume of smoke outbreak decreases further and fire retardancy improves further.

[0099] As a chlorine capture compound, carbonates, such as a calcium carbonate, a lithium carbonate, and a magnesium carbonate, are suitable, and especially, since it is desirable, specific surface area is large and the fine particles of a carbonate 0.1 micrometers or less tend to react with chlorine, 0.5 micrometers or less of mean particle diameter are used very suitably. In addition, a tin compound, a zeolite, a barium sulfate, potassium titanate, a sodium compound, a magnesium compound, an aluminium compound, a lithium compound, etc. are used.

[0100] Moreover, as a minerals assistant, it is independent, or they are used by a silica, an alumina, aluminum silicate, two or more sorts of talc, etc., mixing.

[0101] It is necessary to make the content of a chlorine capture compound or a minerals assistant into 2 - 30 weight section, and when fewer than 2 weight sections, the yield of corrosive gas or smoke seldom decreases, but the further fire-resistant improvement also becomes difficult. On the other hand, when a content exceeds 30 weight sections, the chemical resistance of a Plastic solid, reinforcement, bending workability, a moldability, etc. fall. The still more desirable content of a chlorine capture compound is 7 - 20 weight section, and the still more desirable content of a minerals assistant is 2 - 15 weight section.

[0102] In addition, Plastic solid A1 of monolayer structure - A5 which mentioned above an above-mentioned chlorine capture compound or an above-mentioned minerals assistant Plastic solid A6 of the double layer structure which 2-30 weight section content was carried out similarly, and you may make it raise fire retardancy further, and was mentioned above, and A7 A substratum may be made to contain.

[0103] Plastic solid B1 of monolayer structure explained above, B-2, B3, and B4 The Plastic solid which made these contain a chlorine capture compound or a minerals assistant further A titanium compound, a foaming agent, a cross linking agent, a radical generating agent, a decomposition accelerator, a chlorine capture compound, It fabricates in the configuration of a request of the vinyl chloride system resin constituent which chose and blended a minerals assistant, other additives, etc. of monotonous and others with extrusion molding, a calender press, injection molding, and other well-known forming technique, and is obtained. such a Plastic solid -- as it is -- or fabricating is carried out further, a container etc. is manufactured and it is used suitable for various applications, especially semiconductor fabrication machines and equipment, etc.

[0104] Next, Plastic solid B5 of double layer structure The substratum is a layer which carries out 5-50 weight section content of the titanium compound to the vinyl chloride system resin 100 weight section,

and the surface layer which carried out laminating unification becomes at least one side of this substratum from the layer which carries out 0.0005-10 weight section content in 0 - 30 weight section and a foaming agent about a titanium compound to the vinyl chloride system resin 100 weight section. As for the content of the titanium compound of a surface layer, it is desirable to make it contain fewer than that of a substratum.

[0105] Vinyl chloride system resin, a titanium compound, and a foaming agent are said Plastic solid B1. The same thing as what was used is used, and optimum dose combination of the various additives, such as a lead system or a tin system stabilizer required for shaping, lubricant, processing aid, and a coloring agent, is carried out at a substratum and a surface layer.

[0106] The above-mentioned surface layer is Plastic solid B5. Since it is for suppressing surface physical properties especially chemical resistance, and a corrosion-resistant fall, forming in both sides of a substratum is desirable, but it is enough, if it may be formed only in one side of a substratum and there is about 0.4-1.1mm of the thickness.

[0107] Plastic solid B5 of such double layer structure Since there are few contents of the titanium compound of a surface layer as [below] 30 weight sections, it is Plastic solid B5. A front face has the good chemical resistance and the good corrosion resistance of vinyl chloride system resin original, and embrittlement of the surface layer is not carried out. And since 5-50 weight section content of the titanium compound which demonstrates a heat cutoff operation and a carbonization promotion operation to the substratum of this Plastic solid is carried out and 0.0005-10 weight section content of the foaming agent which demonstrates a heat cutoff operation and a gas capture operation to a surface layer is carried out, it is this Plastic solid B5. It has the fire retardancy which was excellent as a whole.

[0108] Since the amount of vinyl chloride system resin of a surface layer will decrease too much, it will become impossible to maintain the good chemical resistance of vinyl chloride system resin original, and corrosion resistance and the reinforcement of a surface layer will also fall although the fire retardancy of a surface layer improves if the content of the titanium compound of a surface layer exceeds 30 weight sections, it is necessary to make the content of a titanium compound below into 30 weight sections as mentioned above. Although considering as zero is also possible, the content of a titanium compound makes thickness of a surface layer thin at this time, and should just make [many] the content of the titanium oxide of a substratum.

[0109] Furthermore, in order for reinforcement to also fall while the chemical resistance and the corrosion resistance of a surface layer fall if a heat cutoff operation and gas capture acting according to foaming become inadequate if the content of the foaming agent of a surface layer becomes less than the 0.0005 weight section and it increases more than 10 weight sections conversely, it is necessary to make the content of the foaming agent of a surface layer into 0.0005 - 10 weight section as mentioned above. In addition, the still more desirable content of the titanium compound of a surface layer is 3 - 15 weight section, and the still more desirable content of a foaming agent is 0.05 - 10 weight section.

[0110] Moreover, if the content of the titanium compound of a substratum becomes less than 5 weight sections, it will become difficult to raise fire retardancy, and if a large quantity is made to contain from 50 weight sections, in order for the reinforcement of a substratum, bending workability, etc. to fall, it is necessary to make the content of the titanium compound in a substratum into 5 - 50 weight section as mentioned above.

[0111] This Plastic solid B5 It is desirable especially to set, to be making the content of the titanium compound of a surface layer fewer than that of a substratum, to suppress the effect of the chemical resistance on a titanium compound as much as possible, and to raise fire retardancy by the substratum. Therefore, making 3 - 15 weight section and a substratum carry out 15-35 weight section content of the titanium compound is preferably adopted as a surface layer.

[0112] Next, Plastic solid B6 of double layer structure It is the Plastic solid which carried out the laminating unification of the surface layer at least at one side of a substratum. A substratum As opposed to the vinyl chloride system resin 100 weight section a titanium compound 5 - 50 weight section, It is the layer of a radical generating agent and a decomposition accelerator which carries out 0.0005-10 weight section content of any one sort at least, and a surface layer consists a titanium compound of a

layer which carries out 0.0005-10 weight section content in 0 - 30 weight section and a foaming agent to the vinyl chloride system resin 100 weight section.

[0113] Vinyl chloride system resin, a titanium compound, a foaming agent, a radical generating agent, and a decomposition accelerator are said Plastic solid B1, B-2, and B3. The same thing as what was used is used and optimum dose combination of the various additives, such as a lead system or a tin system stabilizer required for a substratum and a surface layer, lubricant, processing aid, and a coloring agent, is carried out. Moreover, the thickness of a surface layer is said Plastic solid B5. It is the same as that of the thickness of a surface layer.

[0114] This Plastic solid B6 A surface layer is said Plastic solid B5. Since it is the same presentation as a surface layer, the front face has good chemical resistance and good corrosion resistance. And in a substratum, it is said Plastic solid B-2 and B3. Since a decomposition accelerator and a radical generating agent are contained similarly and a foaming agent is contained in a surface layer, the corrosive gas produced in early disassembly of the vinyl chloride system resin of a substratum and smoke are captured with the air bubbles generated with the foaming agent of a surface layer, and promotion of carbonization and gas capture are performed with sufficient balance. Therefore, this Plastic solid B6 It has the fire retardancy which was excellent as a whole.

[0115] In addition, Plastic solid B5 of such double layer structures and B6 It also sets, and it is possible to make a substratum carry out 2-30 weight section content of an above-mentioned chlorine capture compound and an above-mentioned minerals assistant, fire retardancy improves further in that case, and volume of smoke outbreak and the amount of corrosion-resistant generation of gas decrease.

[0116] Plastic solid B5 of such double layer structures, and B6 The vinyl chloride system resin constituent for substratum shaping which chose and blended a titanium compound, a radical generating agent, a decomposition accelerator, a chlorine capture compound, a minerals assistant, other additives, etc., The vinyl-chloride-resin constituent for surface layer shaping which blended a titanium compound, a foaming agent, other additives, etc. is prepared. These constituents with the means of multilayer extrusion shaping, a calender press, a lamination, and others Laminate molding is carried out to a desired configuration, and it is manufactured, and in addition to the outstanding fire retardancy, since surface chemical resistance and corrosion resistance are good, it is suitably used as ingredients, such as the application as which surface chemical resistance etc. is required, for example, the washing tub which are some semiconductor fabrication machines and equipment.

[0117] In addition, fire-resistant vinyl-chloride-resin Plastic solid B5 of the above-mentioned double layer structure and B6 Although a surface layer is made to contain a titanium compound and a foaming agent, it may replace with a foaming agent and the decomposition accelerator which are other fire-resistant grant components, a radical generating agent, or a cross linking agent may be made to contain.

[0118] Next, Plastic solid C which does not contain a fire-resistant grant component is explained including a titanium compound.

[0119] This Plastic solid C is a Plastic solid of the monolayer structure of carrying out 5-50 weight section content of the potassium titanate to the vinyl chloride system resin 100 weight section, and optimum dose combination of the various additives, such as a lead system or a tin system stabilizer required for shaping, lubricant, processing aid, and a coloring agent, is carried out at this Plastic solid C. what was used for each above-mentioned Plastic solid as vinyl chloride system resin -- the same thing is used.

[0120] If 5-50 weight section content of the potassium titanate which is a titanium compound is carried out like this Plastic solid C, in order that potassium titanate may demonstrate a heat cutoff operation and a carbonization promotion operation in case of a fire, fire retardancy improves and the yield of smoke or corrosive gas decreases.

[0121] Although things of any configurations, such as what has granular potassium titanate, and a fibrous thing, are used, the granular thing whose mean particle diameter is 0.1-0.5 micrometers has good kneading nature, and the diameter of fiber can acquire the Plastic solid of the high rigidity [thing / whose die length is 5-30 micrometers in 0.1-1 micrometer / fibrous] in high intensity.

[0122] The content of potassium titanate needs to consider as 5 - 50 weight section, and under in 5

weight sections, if it becomes difficult to raise fire retardancy and a large quantity is made to contain from 50 weight sections, the chemical resistance of Plastic solid C, reinforcement, bending workability, etc. will fall. The still more desirable content of potassium titanate is 8 - 30 weight section.

[0123] Plastic solid C of such monolayer structure is fabricated in the configuration of a request of the vinyl chloride system resin constituent which chose and blended potassium titanate, other additives, etc. of monotonous and others with extrusion molding, a calender press, injection molding, and other well-known forming technique, is acquired, and is used for remaining as it is or the various applications as which fabricating is further carried out and thermal resistance is required.

[0124] Next, transparent Plastic solid D which contains either of the fire-resistant grant components as preferably as the Lynn system flame retarder or a zinc compound is explained. Plastic solid D1 of the monolayer structure which uses the high vinyl chloride system resin of whenever [chlorination] as main operation gestalten of this Plastic solid D, Plastic solid D3 of the monolayer structure where whenever [D2 and chlorination] uses ordinary vinyl chloride system resin, Plastic solid D4 of the laminated structure which uses either or the both sides of the high vinyl chloride system resin of whenever [chlorination], and vinyl chloride system resin with whenever [chlorination / ordinary], D5, D6, and D7 etc. -- it can mention.

[0125] first, transparent Plastic solid D1 using vinyl chloride system resin with whenever [chlorination / as high] as abbreviation 58 - 73% of abbreviation As opposed to this vinyl chloride system resin 100 weight section the Lynn system flame retarder 0.5 - 15 weight section, In considering as a basic presentation what carried out 0.5-7 weight section content of 0.5 - 20 weight section and the tin system stabilizer for chlorinated polyethylene and asking for it Furthermore, even if there are few a foaming agent which is a fire-resistant grant component, decomposition accelerators, radical generating agents, and cross linking agents, 0.0005-10 weight section content of a kind is carried out.

[0126] The mixed resin whenever [average chlorination / which mixed the thing same as vinyl chloride system resin whenever / chlorination / whose / are abbreviation 58 - 73% of abbreviation as what was used for the surface layer of above-mentioned Plastic solid A7, i.e., the back chlorinated polyvinyl chloride resin whenever / chlorination / whose / are abbreviation 58 - 73% of abbreviation, vinyl chloride resin common to chlorinated polyvinyl chloride resin after this; vinyl acetate resin, acrylic resin, vinyl chloride-vinyl acetate copolymerization resin, etc. / whose] are abbreviation 58 - 73% of abbreviation is used. Among these, the thing of back chlorinated polyvinyl chloride resin is used preferably.

[0127] In order that the high vinyl chloride system resin abbreviation 58 - 73% of abbreviation, and above-mentioned may generate a lot of chlorine gas by the pyrolysis compared with the common vinyl chloride resin whenever [chlorination / whose] is 56% of abbreviation and whenever [chlorination] may delay combustion, it is ingredient resin advantageous to acquiring the Plastic solid excellent in fire retardancy. Resin with whenever [from a fire-resistant viewpoint / chlorination / higher] is more advantageous, and the vinyl chloride system resin with whenever [chlorination / higher ** than 73% of abbreviation] is difficult to manufacture, and since thermal stability, a moldability, bending workability, chemical resistance, corrosion resistance, etc. are bad, it is unsuitable as raw material resin.

[0128] As the above-mentioned Lynn system flame retarder which vinyl chloride system resin is made to contain Halogen-containing phosphoric ester, halogen-containing condensed-phosphoric-acid ester, non-halogen phosphoric ester, The thing of organic phosphorus systems, such as non-halogen condensed-phosphoric-acid ester and orthophosphoric-acid ester, is suitable. For example, tris (chloro ethyl) phosphate, tris (chloropropyl) phosphate, Tris (dichloro propyl) phosphate, trimethyl phosphate, triphenyl phosphate, tricresyl phosphate, cresyl diphenyl phosphate, 2-ethylhexyl diphenyl phosphate, etc. are used preferably.

[0129] Since it excels in transparency compared with flame retarders, such as a halogen system flame retarder and antimony oxide, such an organic phosphorus system flame retarder is transparent Plastic solid D1. Are advantageous to obtaining. Moreover, at the time of combustion While this organic phosphorus system flame retarder pyrolyzes, a phosphoric acid is generated, and this phosphoric acid remains on the front face of vinyl chloride system resin and bars oxygen transfer, in order to promote

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surface carbonization and to control combustion, it is Plastic solid D1. Fire retardancy can be raised. Moreover, since this organophosphate acts also as internal lubricant or external lubricant, it has the advantage which does not need to use the lubricant which does not give the fire retardancy of other higher fatty acids etc.

[0130] In addition, inorganic phosphorus system flame retarders, such as red phosphorus, are also usable in the range which does not spoil transparency.

[0131] It acts also as a reinforcing agent, a mechanical strength is raised, and the above-mentioned chlorinated polyethylene which vinyl chloride system resin is made to contain is Plastic solid D1. Required practical strength is given. As for this chlorinated polyethylene, that whenever [chlorination / whose] is 25 - 45% is used suitably. If this chlorinated polyethylene is made to contain, in order that the chlorine gas which occurs by the pyrolysis may delay combustion of resin, it is Plastic solid D1. Fire retardancy can be raised. Since there are few yields of chlorine gas, as for less than 25% of chlorinated polyethylene, whenever [chlorination] is disadvantageous for fire-resistant improvement, and since there is un-arranging [that the reinforcement effectiveness of chlorination whenever seldom improves as for 45% or more of chlorinated polyethylene], it is not desirable. In addition, although the thing of acrylic or an MBS system is also considered as a reinforcing agent, since these do not have a fire-resistant operation, they are not desirable.

[0132] It is necessary to carry out 0.5-15 weight section content of the aforementioned Lynn system flame retarder to the vinyl chloride system resin 100 weight section, and to carry out 0.5-20 weight section content of the chlorinated polyethylene. For each content of the Lynn system flame retarder and chlorinated polyethylene, the case of under the 0.5 weight section is Plastic solid D1. It becomes difficult to fully raise fire retardancy. If it will come to cause the fall of transparency on the other hand if the content of the Lynn system flame retarder increases more than 15 weight sections, and the content of chlorinated polyethylene increases more than 20 weight sections, transparency will fall and required total light transmission will not be obtained. It of 2 - 10 weight section and chlorinated polyethylene of the desirable content of the Lynn system flame retarder is 3 - 15 weight section.

[0133] Since combination of a plasticizer or lubricant weakens fire retardancy and reduces transparency, it is desirable to make it not blend as much as possible, and not blending, if it can do is desirable. However, the tin system stabilizer which is a thermostabilizer must be blended. As a tin system stabilizer, all the things that have a conventionally well-known dibutyltin maleate system, a conventionally well-known dibutyltin laurate system, etc. are usable, and it is necessary to make the content into 0.5 - 7 weight section to the vinyl chloride system resin 100 weight section. Under in the 0.5 weight section, the thermal stability at the time of shaping falls, and since the heat stabilizing effect corresponding to it is not obtained even if it blends mostly from 7 weight sections on the other hand, it becomes futility. In addition, the stabilizer of a lead system is unsuitable when acquiring the Plastic solid of transparent vinyl chloride system resin.

[0134] fire-resistant vinyl chloride system resin Plastic solid D1 with the above transparent basic presentations **** -- the foaming agent which is the fire-resistant grant component mentioned above, a decomposition accelerator, a radical generating agent, and a cross linking agent -- any one sort is made to contain at least, fire retardancy may be raised further, or an ultraviolet ray absorbent is made to contain and weatherability may be raised.

[0135] The above-mentioned fire-resistant grant component is Plastic solid D1, when it is required to make it contain at a rate of 0.0005 - 10 weight section to the vinyl chloride system resin 100 weight section and a content becomes less than the 0.0005 weight section. It becomes difficult to raise fire retardancy further, and on the other hand, since the fire-resistant disposition top effectiveness of having balanced it is not acquired even if it makes [more] a content than 10 weight sections, it becomes useless. Each desirable content of a fire-resistant grant component is [at 0.0005 - 5 weight section and a radical generating agent] 0.005 - 5 weight section with 0.05 - 10 weight section and a decomposition accelerator in a foaming agent in 0.0005 - 5 weight section and a cross linking agent.

[0136] In addition, optimum dose combination may be carried out in the range which does not check fire retardancy for coloring agents, ultraviolet ray absorbents, etc., such as a pigment and a color, to the

above-mentioned constituent.

[0137] Plastic solid D1 of the basic presentation mentioned above When the thickness is 5mm, the Hayes value serves as [total light transmission] 60% or less of transparent Plastic solid 50% or more, and lighting nature and fluoroscopy nature are good. The values with desirable above-mentioned total light transmission and Hayes value are 70% or more and 30% or less, respectively. And Plastic solid D1 of this basic presentation Since fire retardancy is raised by the Lynn system flame retarder and chlorinated polyethylene to the top where whenever [chlorination / of vinyl chloride system resin] is high, there is also little volume of smoke outbreak that it is hard to burn. Moreover, fire retardancy of the Plastic solid which made the fire-resistant grant component contain further improves further.

[0138] Another transparent Plastic solid D2 using vinyl chloride system resin with whenever [chlorination / as high] as abbreviation 58 - 73% of abbreviation To this vinyl chloride system resin 100 weight section, even if there are few a foaming agent which are 0.5 - 7 weight section and a fire-resistant grant component about 0.5 - 15 weight section and a tin system stabilizer in either the Lynn system flame retarder or chlorinated polyethylene, decomposition accelerators, radical generating agents, and cross linking agents, 0.0005-10 weight section content of a kind is carried out.

[0139] As the vinyl chloride system resin whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation, the Lynn system flame retarder, chlorinated polyethylene, and a tin system stabilizer, it is above-mentioned Plastic solid D1. What the same thing as what was used was used, and was mentioned already as a fire-resistant grant component is used. Moreover, the desirable content is also Plastic solid D1. It is the same.

[0140] This Plastic solid D2 Although the Hayes value becomes [total light transmission] 60% or less 40% or more and lighting nature and fluoroscopy nature are good when thickness is 5mm, it is good preferably for total light transmission to adjust the content of each component within the limits of the above-mentioned content so that 60% or more and the Hayes value may become 30% or less.

[0141] This Plastic solid D2 Like, when [of the foaming agent which is a fire-resistant grant component, a decomposition accelerator, a radical generating agent, and a cross linking agent] blending a kind as an indispensable component at least It is Plastic solid D2 by this fire-resistant grant component. Since fire retardancy is raised Above-mentioned Plastic solid D1 It is Plastic solid D2 only at it becoming unnecessary to make the both sides of the Lynn system flame retarder and chlorinated polyethylene contain like, and making either the Lynn system flame retarder or chlorinated polyethylene contain. It becomes possible to give the outstanding fire retardancy.

[0142] When the content of either the Lynn system flame retarder or chlorinated polyethylene is made fewer than the 0.5 weight section and the content of a fire-resistant grant component is made fewer than the 0.0005 weight section, it is Plastic solid D2. Transparency is Plastic solid D2, although it improves. It becomes difficult to raise fire retardancy notably. On the other hand, even if it makes [more] the content of either the Lynn system flame retarder or chlorinated polyethylene than 15 weight sections and makes [more] the content of a fire-resistant grant component than 10 weight sections, the fire-resistant disposition top effectiveness of having balanced it is not acquired, but it is Plastic solid D2 on the contrary. The sharp fall of transparency will be caused.

[0143] In addition, this Plastic solid D2 It is possible to also set and to carry out optimum dose combination of coloring agents, ultraviolet ray absorbents, etc., such as a pigment and a color, in the range which does not check fire retardancy.

[0144] above fire-resistant vinyl chloride system resin Plastic solids D1 of transparence, and D2 the resin constituent which blended the Lynn system flame retarder, and the both sides and tin system stabilizer of chlorinated polyethylene with the vinyl chloride system resin whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation -- or The resin constituent of the Lynn system flame retarder or either of chlorinated polyethylene and a tin system stabilizer, and a fire-resistant grant component which blended a kind at least is prepared to the vinyl chloride system resin whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation. These resin constituents with melting extrusion molding, calender press forming, injection molding, and other well-known shaping means what is manufactured by fabricating in the configuration of requests, such as section shapes, such as a

plate, a pipe, the round bar, an electrode, and an angle type, -- it is -- as it is -- or fabricating is carried out and it is used for various kinds of applications. In addition, Plastic solid D1 and D2 Although what is necessary is for there to be no limit about thickness and just to determine suitably in consideration of an application etc., if it is made the thickness of about 3-15mm, sufficient practical strength can usually be given.

[0145] Next, Plastic solid D3 using vinyl chloride system resin To this vinyl chloride system resin 100 weight section, a zinc compound is converted into the amount of metal zinc, 0.5-7 weight section content of 0.005 - 5 weight section and the tin system stabilizer is carried out, the total light transmission is 40% or more, and the Hayes value is 60% or less of transparent Plastic solid. This Plastic solid D3 Since disassembly of vinyl chloride system resin is promoted with a zinc compound and carbonization is brought forward, it has the outstanding fire retardancy. The range where total light transmission and the Hayes value are desirable is 60% or more and 30% or less, respectively, and it is desirable to adjust the content of a zinc compound or a tin system stabilizer within the limits of the above so that such total light transmission and the Hayes value may be acquired.

[0146] As vinyl chloride system resin, the common vinyl chloride resin whenever [chlorination / whose] is 56.4%, the back chlorinated polyvinyl chloride resin whenever [chlorination / whose] is 57 - 73%, the resin which mixed these resin and made whenever [chlorination] the favorite thing, and the resin which mixed kinds, such as vinyl acetate resin and vinyl chloride-vinyl acetate copolymerization resin, or two sorts to these vinyl chloride resin are used. When the vinyl chloride system resin whenever [chlorination / whose] is 58 - 73% of abbreviation among these resin is used, it is desirable although ***** excellent in fire retardancy is obtained. Moreover, if the vinyl chloride resin whenever [chlorination / whose] is 56.4% is used, since it can consider as the Plastic solid excellent in chemical resistance, carbonization is moreover brought forward with a zinc compound and fire retardancy can be given from the resin whenever [chlorination / whose] is 58 - 73%, it is used preferably.

[0147] As a zinc compound, the zinc stearate used as the above-mentioned decomposition accelerator, lauric-acid zinc, zinc benzoate, etc. are suitable, and if such a zinc compound is made to contain, since carbonization of vinyl chloride system resin will be promoted by the good thermal conductivity of the pitch solution promotion operation metallurgy group zinc of a zinc compound at the time of combustion, it becomes the Plastic solid excellent in fire retardancy. If it becomes difficult to give sufficient fire retardancy for a Plastic solid if the content of a zinc compound converts into the amount of metal zinc and becomes less than the 0.005 weight section and it increases more than 5 weight sections on the other hand, transparency will worsen. Since the zinc content of each zinc compound is 14.5% in PARATA challis butyl zinc benzoate, it makes each zinc compound contain 14.0%, with lauric-acid zinc, 10.5%, with zinc stearate, so that the amount of metal zinc may serve as the above-mentioned range. In addition, since a zinc compound acts also as lubricant, it can be managed, even if do not make it other opacity, it does not reduce the lubricant which make it easy to burn or it does not use it.

[0148] Moreover, as a tin system stabilizer, what has the conventionally well-known above-mentioned dibutyltin maleate system, a conventionally well-known dibutyltin laurate system, etc. is used, and the content is the same as that of the case of above-mentioned Plastic solid D1 and D2.

[0149] in addition, this Plastic solid D3 **** -- optimum dose combination of a plasticizer, lubricant, processing aid, a coloring agent, the ultraviolet ray absorbent, etc. is carried out other than the above-mentioned zinc compound and a tin system stabilizer.

[0150] fire-resistant vinyl chloride system resin Plastic solid D3 of the above presentations **** -- the above-mentioned foaming agent which is a fire-resistant grant component, a decomposition accelerator, a radical generating agent, and a cross linking agent -- any one sort may be made to contain further at least, and fire retardancy may be raised further. The content of a fire-resistant grant component is above-mentioned Plastic solid D1 and D2. It is the same as that of a case.

[0151] Such Plastic solid D3 Besides a zinc compound and a tin system stabilizer, plasticizer, The vinyl chloride system resin constituent which carried out optimum dose combination of the fire-resistant grant component etc. lubricant, processing aid, and if needed is prepared. above-mentioned Plastic solid D1 and D2 what is manufactured by fabricating with melting extrusion molding, calender press forming,

injection molding, and other well-known shaping means in a desired configuration like a case -- it is -- as it is -- or fabricating is carried out and it is used for various kinds of applications.

[0152] Plastic solid D1 explained above, D2, and D3 Plastic solid D4 of the following laminated structures which formed the surface layer in both sides or one side of a substratum, for example although each was the thing of monolayer structure, D5, D6, and D7 ***** -- it is good.

[0153] Namely, Plastic solid D4 As opposed to the vinyl chloride system resin 100 weight section whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation While carrying out 0.5 - 15 weight section for the Lynn system flame retarder and carrying out 0.5-7 weight section content of 0.5 - 20 weight section and the tin system stabilizer for chlorinated polyethylene If needed, a kind was made to contain further at least and a fire-resistant grant component forms a substratum with a thickness of 2-14mm. A surface layer whenever [chlorination] is 56% of abbreviation, while carrying out vinyl chloride system resin 100 weight ****, converting a zinc compound into the amount of metal zinc and carrying out 0.5-7 weight section content of 0.005 - 5 weight section and the tin system stabilizer A plasticizer, lubricant, processing aid, etc. and if needed, it is the thing of a fire-resistant grant component which carried out optimum dose combination of a kind at least, and forms in a layer with a thickness of 0.4-2mm.

[0154] Plastic solid D4 of such a laminated structure The thermal stability at the time of shaping is good, and a surface layer is not only excellent in chemical resistance and corrosion resistance, but moreover, since the pyrolysis difference of the thickness direction is lost, it becomes the thing excellent in fire retardancy.

[0155] Moreover, Plastic solid D5 As opposed to the transparent vinyl chloride system resin 100 weight section whenever [chlorination / whose] are abbreviation 58 - 73% of abbreviation 0.5 - 15 weight section and chlorinated polyethylene for the Lynn system flame retarder 0.5 - 20 weight section, Made the basic presentation which carried out 0.5-7 weight section content of the tin system stabilizer carry out 0.0005-10 weight section content of the further aforementioned decomposition accelerator, and a substratum with a thickness of 2-14mm is formed in it. It is the Plastic solid which this basic presentation was made to carry out 0.0005-10 weight section content of the foaming agent further, and formed the surface layer with a thickness of 0.4-2mm in it.

[0156] Such Plastic solid D5 Since there are few content total amounts occupied in the Plastic solid of a foaming agent, transparency is good, and moreover, since the smoke decomposed and produced in a substratum at the time of combustion and hydrogen chloride gas are incorporated by the air bubbles produced by foaming of a surface layer, the vaporizing capacity demonstrates the fire retardancy which was excellent few. In this case, chemical resistance can be raised by using the resin to which the low resin or common vinyl chloride resin of whenever [chlorination] was added, and whenever [apparent chlorination] was reduced from the thing of a substratum as resin of a surface layer.

[0157] Moreover, Plastic solid D6 As opposed to the general vinyl chloride system tree 100 weight section whenever [chlorination / whose] is 56% of abbreviation The zinc compound was converted into the amount of metal zinc, 0.5-7 weight section content of 0.005 - 5 weight section and the tin system stabilizer is carried out, and a substratum with a thickness of 2-14mm is formed. A surface layer While carrying out 0.5-7 weight section content of the tin system stabilizer to the vinyl chloride system resin 100 weight section whenever [aforementioned chlorination / whose] is 56% of abbreviation, it is the Plastic solid which was made to carry out 0.0005-10 weight section content of the foaming agent, and was formed in the layer with a thickness of 0.4-2mm.

[0158] Such Plastic solid D6 Since the amount of generation of gas can be decreased by incorporating a case by the air bubbles which produce the gas produced in a substratum in a surface layer, the outstanding fire retardancy is demonstrated. In addition, optimum dose combination of a plasticizer, processing aid, or the ultraviolet ray absorbent may be carried out at a substratum or a surface layer.

[0159] Moreover, Plastic solid D7 As opposed to the general vinyl chloride system resin 100 weight section whenever [chlorination / whose] is 56% of abbreviation A tin system stabilizer 0.5 - 7 weight section, a foaming agent, a decomposition accelerator, a radical generating agent, 0.0005-10 weight section content of any one sort is carried out at least, and a cross linking agent forms a substratum with a

thickness of 2-14mm. A surface layer It is the Plastic solid with which whenever [chlorination] carries out 0.5-7 weight section content of 0.5 - 20 weight section and the tin system stabilizer, and formed the Lynn system flame retarder and/or chlorinated polyethylene in the layer with a thickness of 0.4-2.0mm to the vinyl chloride system resin 100 weight section which is 58 - 73%.

[0160] Such Plastic solid D7 A substratum is carried out with a foaming agent etc., flameproofing of the surface layer is carried out by the Lynn system flame retarder etc., respectively, and a case demonstrates the outstanding fire retardancy.

[0161] Next, the still more concrete example of this invention is explained.

[0162] To the vinyl-chloride-resin (U-PVC) 100 weight section whenever [chlorination / of [examples 1-4] marketing / whose] is 56% of abbreviation, the lead stabilizer 4 weight section, the lubricant 2 weight section, and the processing aid 4 weight section were added, it mixed to homogeneity, and the basic combination constituent (U-PVC use) was prepared. As opposed to this basic constituent 110 weight section as a foaming agent an AZOJI carvone amide A triazine thiol as a radical generating agent as a cross linking agent JIAMIRU peroxide After mixing lauric-acid zinc alternatively as a decomposition accelerator at a rate shown in Table 1, preparing four kinds of resin constituents and producing calendered sheeting with these resin constituents, by pressing The fire-resistant vinyl-chloride-resin plate (5mm in thickness) of the monolayer structure which is four kinds from which a presentation differs was obtained.

[0163] And the four above-mentioned kinds of resin plates (50x50x5mm) were put into the electric furnace heated at 800 degrees C, the existence of ignition and the time amount of until it lights were investigated, and the fire-resistant test was performed. The result is shown in the following table 1.

[0164] Moreover, about each above-mentioned resin plate, the mechanical strength and chemical resistance were investigated and the result was collectively shown in Table 1. This mechanical strength is JIS. Measuring Izod impact strength, tensile strength, and an elongation percentage based on K6745, the appearance discoloration after being immersed in each drug solution of aqueous ammonia for seven days at 23 degrees C a sulfuric acid, 35% sulfuric acid, and 28% 97% is observed, and chemical resistance makes x those remarkable with discoloration by making those with discoloration, and ** into those with discoloration slightly, and displays discoloration nothing and O for O.

[0165] To the back chlorinated-polyvinyl-chloride-resin (C-PVC) 100 weight section whenever [[example 5] chlorination / whose] is 64% of abbreviation, the lead stabilizer 4 weight section, the lubricant 2 weight section, and the processing aid 4 weight section were added, it mixed to homogeneity, and the basic combination constituent (C-PVC use) was prepared. After having carried out 0.5 weight section mixing of the lauric-acid zinc as a decomposition accelerator, preparing the resin constituent to this basic combination constituent 110 weight section and producing calendered sheeting using this resin constituent, the fire-resistant vinyl-chloride-resin plate (5mm in thickness) of monolayer structure was obtained by pressing.

[0166] And while performing the fire-resistant test like examples 1-4 about this resin plate, that mechanical strength and chemical resistance were investigated. The result is shown in the following table 1.

[0167] While carrying out 0.5 weight section combination of the JIAMIRU peroxide as a radical generating agent and preparing the constituent for substrata to the basic combination constituent (U-PVC use) 110 weight section prepared in the [example 6] examples 1-4, to the basic combination constituent 110 weight section prepared in the examples 1-4, 0.5 weight section combination of the AZOJI carvone amide was carried out as a foaming agent, and the constituent for surface layers was prepared.

[0168] And the fire-resistant vinyl-chloride-resin plate (5mm in the whole thickness) of 3 layer structures which have a surface layer with a thickness of 0.5mm to both sides of a substratum with a thickness of 4mm was obtained by producing calendered sheeting of these constituents for substrata, and the constituent for surface layers, respectively, making it pile up mutually, and pressing.

[0169] While performing the fire-resistant test like examples 1-5 about this resin plate, that mechanical strength and chemical resistance were investigated. The result is shown in Table 1.

[0170] While carrying out 0.5 weight section combination of the lauric-acid zinc as a decomposition accelerator and preparing the constituent for substrata to the basic combination constituent (U-PVC use) 110 weight section prepared in the [example 7] examples 1-4 To the basic combination constituent 110 weight section prepared in the examples 1-4, the AZOJI carvone amide was carried out as a foaming agent, 0.2 weight section combination of the lauric-acid zinc was carried out as the 0.3 weight section and a decomposition accelerator, and the constituent for surface layers was prepared.

[0171] And the fire-resistant vinyl-chloride-resin plate (5mm in the whole thickness) of 3 layer structures which have a surface layer with a thickness of 0.5mm to both sides of a substratum with a thickness of 4mm was obtained by producing calendered sheeting of these constituents for substrata, and the constituent for surface layers, respectively, making it pile up mutually, and pressing.

[0172] While performing the fire-resistant test like examples 1-5 about this resin plate, that mechanical strength and chemical resistance were investigated. The result is shown in Table 1.

[0173]

[Table 1]

		実施例 1	実施例 2	実施例 3	実施例 4	実施例 5	実施例 6		実施例 7	
							表面層	基層	表面層	基層
組成 (重量部)	基本配合組成物 (U-PVC使用)	110	110	110	110	—	110	110	110	110
	基本配合組成物 (C-PVC使用)		—	—	—	110	—	—	—	—
	発泡剤 (アゾジカルボンアミド)	0.1	—	—	—	—	0.5	—	0.3	—
	架橋剤 (トリアジンチオール)	—	0.7	—	—	—	—	—	—	—
	ラジカル発生剤 (ジアミルパーオキサイド)	—	—	0.7	—	—	—	0.5	—	—
	分解促進剤 (ラウリン酸亜鉛)	0.5	—	—	0.7	0.5	—	—	0.2	0.5
強度	アイソット衝撃強さ (KJ/m ²)	6.0	6.0	6.0	6.0	5.4	6.0		6.0	
	引張り強度 (N/mm ²)	50	50	50	50	50	50		50	
	伸び率 (%)	160	150	150	150	100	140		160	
難燃性 テスト	着火の有無	無	無	無	無	無	無		無	
	着火時間(秒)	—	—	—	—	—	—		—	
耐薬品性	97% 硫酸	◎	○	○	○	◎	◎		◎	
	35% 硫酸	◎	○	○	○	◎	◎		◎	
	28% アンモニア水	◎	◎	◎	◎	◎	◎		◎	

[0174] If this table 1 is seen, it turns out that no fire-resistant vinyl-chloride-resin plates of the examples 1-7 which made a kind contain at least of a fire-resistant grant component are lit, but it has good fire retardancy. And impact strength, tensile strength, the elongation of the resin plate of the examples 1, 2, 3, 4, 6, and 7 which used the vinyl chloride resin (U-PVC) whenever [chlorination / whose] is 56% of abbreviation, etc. are enough. On the other hand, although the resin plate of the example 5 which used the back chlorinated polyvinyl chloride resin (C-PVC) whenever [chlorination / whose] is 64% of abbreviation is a little inferior in impact strength, tensile strength, elongation, etc. compared with the resin plate of other examples In spite of being still in sufficient level and using the back chlorinated polyvinyl chloride resin of whenever [weak high chlorination] for chemical resistance, the chemical

resistance which was excellent by carrying out little content of the lauric-acid zinc as a decomposition accelerator with the 0.5 weight section is provided. Moreover, it has the chemical resistance the content of a fire-resistant grant component excelled [chemical resistance] also in as few resin plates of 3 layer structures of examples 6 and 7 as [the 0.5 weight section].

[0175] As opposed to the basic combination constituent (U-PVC use) 110 weight section prepared in the [examples 8-12] examples 1-4 as a titanium compound The titanium oxide by which the front face was covered with examples 8-11 with the alumina (mean particle diameter: 0.2 micrometers or less of abbreviation), In the example 12, fibrous potassium titanate as a foaming agent again an AZOJI carvone amide The triazine thiol was alternatively mixed as a radical generating agent as a cross linking agent at a rate which shows lauric-acid zinc for JIAMIRO peroxide in the following table 2 as a decomposition accelerator, respectively, and five kinds of resin constituents were prepared. And after producing calendered sheeting with these resin constituents, the fire-resistant vinyl-chloride-resin plate (5mm in thickness) of the monolayer structure which is five kinds from which a presentation differs was obtained by pressing.

[0176] While performing the fire-resistant test like examples 1-4 about these resin plates, the mechanical strength and chemical resistance were investigated. The result is shown in the following table 2.

[0177] To the basic combination constituent (U-PVC use) 110 weight section prepared in the [example 13] examples 1-4, 30 weight sections combination of the titanium oxide was carried out as a titanium compound, and the constituent for substrata was prepared. Moreover, to the basic combination constituent (U-PVC use) 110 weight section prepared in the examples 1-4, titanium oxide was carried out as a titanium compound, 0.5 weight section combination of the AZOJI carvone amide was carried out as 5 weight sections and a foaming agent, and the constituent for surface layers was prepared.

[0178] And the fire-resistant vinyl-chloride-resin plate (5mm in the whole thickness) of 3 layer structures which have a surface layer with a thickness of 0.5mm to both sides of a substratum with a thickness of 4mm was obtained by producing calendered sheeting of these constituents for substrata, and the constituent for surface layers, respectively, making it pile up mutually, and pressing.

[0179] While performing the fire-resistant test like examples 1-4 about this resin plate, that mechanical strength and chemical resistance were investigated. The result is shown in the following table 2.

[0180] To the basic combination constituent (U-PVC use) 110 weight section prepared in the [example 14] examples 1-4, titanium oxide was carried out as a titanium compound, 0.5 weight section combination of the lauric-acid zinc was carried out as 30 weight sections and a decomposition accelerator, and the constituent for substrata was prepared. Moreover, to the basic combination constituent (U-PVC use) 110 weight section prepared in the examples 1-4, titanium oxide was carried out as a titanium compound, 0.5 weight section combination of the AZOJI carvone amide was carried out as 5 weight sections and a foaming agent, and the constituent for surface layers was prepared.

[0181] And the fire-resistant vinyl-chloride-resin plate (5mm in the whole thickness) of 3 layer structures which have a surface layer with a thickness of 0.5mm to both sides of a substratum with a thickness of 4mm was obtained by producing calendered sheeting of these constituents for substrata, and the constituent for surface layers, respectively, making it pile up mutually, and pressing.

[0182] While performing the fire-resistant test like examples 1-4 about this resin plate, that mechanical strength and chemical resistance were investigated. The result is shown in the following table 2.

[0183] The resin constituent which carried out 4 weight sections mixing of the titanium oxide as a titanium compound to the basic combination constituent (U-PVC use) 110 weight section prepared in the [examples 1-2 of comparison] examples 1-4 (example 1 of a comparison), After preparing the resin constituent (example 2 of a comparison) which carried out 55 weight sections mixing of the titanium oxide and producing calendered sheeting like examples 8-12, the fire-resistant vinyl-chloride-resin plate (5mm in thickness) of two kinds of monolayer structures for a comparison was obtained by pressing.

[0184] And while performing the fire-resistant test like examples 1-4 about these resin plates, the mechanical strength and chemical resistance were investigated. The result is shown in the following table 2.

[0185]

[Table 2]

	実施例 8	実施例 9	実施例 10	実施例 11	実施例 12	実施例 13		実施例 14		比較例 1	比較例 2
						表面層	基層	表面層	基層		
組成 (重量部)	基本配合組成物 (U-PVC使用)	110	110	110	110	110	110	110	110	110	110
	チタン化合物 (酸化チタン他)	25	25	25	18	5	30	5	30	4	55
強度	発泡剤 (アジカルボンアミド)	0.5	—	—	—	0.5	—	0.5	—	—	—
	架橋剤 (Nアジチオール)	—	0.5	—	—	—	—	—	—	—	—
	ラジカル発生剤 (シアミルパーオキサイド)	—	—	0.5	—	—	—	—	—	—	—
	分解促進剤 (ラウリン酸亜鉛)	—	—	—	0.5	—	—	—	0.5	0.5	0.5
	アイソット衝撃強さ (KJ/m^2)	6.5	6.5	6.5	7.0	6.5		6.5		6.0	3.0
難燃性	引張り強度 (N/mm^2)	48	48	48	55	50		50		56	58
	伸び率 (%)	100	100	100	130	110		110		180	10
耐薬品性	着火の有無	無	無	無	無	無		無		有	無
	着火時間 (秒)	—	—	—	—	—		—		90	—
	97% 硫酸	△	△	△	△	◎		◎		◎	×
	35% 硫酸	○	○	○	○	◎		◎		◎	×
	28% アンモニア水	◎	◎	◎	◎	◎		◎		◎	△

注) 実施例12で使用したチタン化合物はチタン酸カリウムである。

[0186] If this table 2 is seen, no fire-resistant vinyl-chloride-resin plates of examples 8-14 are lit, but have good fire retardancy, and impact strength, tensile strength, its elongation, etc. are enough. Especially the resin plate of examples 13 and 14 with which the content of a titanium compound was equipped with few surface layers is excellent also in chemical resistance, and it turns out that the resin plate of an example 12 using fibrous potassium titanate excels [content] in the mechanical strength at least.

[0187] On the other hand, although the resin plate of the example 2 of a comparison which has too many contents of a titanium compound is excellent in fire retardancy, it is inferior to chemical resistance and

impact strength and elongation are also inferior in it. Moreover, although the resin plate of the example 1 of a comparison which has too few contents of a titanium compound has reinforcement and good chemical resistance, it turns out that ignition is seen in 90 seconds and it is inferior to fire retardancy. [0188] To the back chlorinated-polyvinyl-chloride-resin (C-PVC) 100 weight section whenever [[examples 15-18] chlorination / whose] is 64% of abbreviation, stearin acid was carried out for the thermostabilizer of a dibutyltin maleate system, 5 weight sections mixing of 2 weight sections and the MBS system reinforcing agent was carried out for 1 weight section and processing aid as 4 weight sections and lubricant, and the basic combination constituent for transparency Plastic solids (C-PVC use) was prepared.

[0189] And this basic combination constituent (C-PVC use) 112 weight section is received. Zinc stearate as a foaming agent as a decomposition accelerator a hydrazide compound A triazine thiol as a radical generating agent as a cross linking agent JIAMIRU peroxide After mixing alternatively at a rate shown in the following table 3, preparing four kinds of resin constituents and producing calendered sheeting with a thickness of 0.5mm using these resin constituents, by pressing these ten calendered sheeting in piles The transparent fire-resistant vinyl-chloride-resin plate (5mm in thickness) of the monolayer structure which is four kinds from which a presentation differs was obtained.

[0190] About these transparent resin plates, it is JIS. Based on K-7105, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured, and the fire-resistant test was further performed like examples 1-4. The result is shown in the following table 3.

[0191] To the general vinyl-chloride-resin (U-PVC) 100 weight section whenever [[examples 19-22] chlorination / whose] is 56% of abbreviation, stearin acid was carried out for the thermostabilizer of a dibutyltin maleate system, 5 weight sections mixing of 2 weight sections and the MBS system reinforcing agent was carried out for 1 weight section and processing aid as 4 weight sections and lubricant, and the basic combination constituent for transparency Plastic solids (U-PVC use) was prepared.

[0192] And this basic combination constituent (U-PVC use) 112 weight section is received. Zinc stearate as a foaming agent as a decomposition accelerator a hydrazide compound A triazine thiol as a radical generating agent as a cross linking agent JIAMIRU peroxide After mixing alternatively at a rate shown in the following table 3, preparing four kinds of resin constituents and producing calendered sheeting with a thickness of 0.5mm using these resin constituents, by pressing these ten calendered sheeting in piles The transparent fire-resistant vinyl-chloride-resin plate (5mm in thickness) of the monolayer structure which is four kinds from which a presentation differs was obtained.

[0193] About these transparent resin plates, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 3:

[0194] To the basic combination constituent (U-PVC use) 112 weight section prepared in the [example 23] examples 19-22, 0.7 weight section combination of the zinc stearate was carried out as a decomposition accelerator, and the constituent for substrata was prepared. Moreover, to the basic combination constituent (C-PVC use) 112 weight section prepared in the examples 15-18, zinc stearate was carried out as a decomposition accelerator, 0.1 weight section combination of the hydrazide compound was carried out as the 0.3 weight section and a foaming agent, and the constituent for surface layers was prepared.

[0195] And the transparent fire-resistant vinyl-chloride-resin plate (5mm in the whole thickness) of 3 layer structures which have a surface layer with a thickness of 0.5mm to both sides of a substratum with a thickness of 4mm was obtained by producing calendered sheeting of these constituents for substrata, and the constituent for surface layers, respectively, making it pile up mutually, and pressing.

[0196] About this transparent resin plate, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 3.

[0197]

[Table 3]

	実施例 15	実施例 16	実施例 17	実施例 18	実施例 19	実施例 20	実施例 21	実施例 22	実施例 23	
									表面層	基層
組成 (重量部)	基本配合組成物 (C-PVC使用) (塩素化度 54%)	112	112	112	—	—	—	—	112	—
	基本配合組成物 (U-PVC使用) (塩素化度 56%)	—	—	—	112	112	112	112	—	112
	分解促進剤 (ステアリン酸亜鉛)	0.5	—	—	0.3	—	—	0.5	0.3	0.7
	発泡剤 (ヒドランジド化合物)	—	—	—	0.1	—	—	0.1	0.1	—
	架橋剤 (トリアジンチオール)	—	0.5	—	—	0.7	—	—	—	—
	ラジカル発生剤 (シアミルパー オキシライド)	—	—	0.5	—	—	0.7	—	—	—
難燃性テスト	着火の有無	無	無	無	無	無	無	無	無	無
	着火時間 (秒)	—	—	—	—	—	—	—	—	—
透 明 性	全光線透過率 (%)	76.8	76.9	75.6	72.4	84.4	83.5	80.1	82.2	—
	拡散光線透過率 (%)	7.3	7.4	7.2	15.3	5.2	5.3	8.8	6.8	—
	平行光線透過率 (%)	69.5	69.5	68.4	57.1	79.2	78.2	71.3	75.4	—
	ヘイズ値 (%)	9.5	9.6	9.5	21.1	6.2	6.3	11.0	8.3	—

[0198] When this table 3 is seen, it turns out that no transparent resin plates of examples 15-23 are lit, but good fire retardancy is demonstrated by work of the fire-resistant grant component contained to each resin plate. And it turns out that 80% or more and the Hayes value are 11% or less, and the resin plate of the monolayer structure of the examples 19-22 which used the usual vinyl chloride resin (U-PVC) whenever [chlorination / whose] is 56% of abbreviation, and the resin plate of 3 layer structures of the example 23 which used this usual vinyl chloride resin (U-PVC) for the substratum excel [light transmission / total] in transparency. On the other hand, although transparency is a little inferior in the transparent resin plate of the examples 15-18 which originally used the post-chlorination vinyl chloride (C-PVC) of whenever [high chlorination / whose transparency is not not much good] compared with

the resin plate of the examples 19-23 which used usual vinyl chloride resin (U-PVC), still total light transmission is 72% or more, a haze value is less than 22%, and it turns out that it has good transparency.

[0199] To the back chlorinated-polyvinyl-chloride-resin (C-PVC) 100 weight section whenever [[example 24] chlorination / whose] is 64% of abbreviation, as a Lynn system flame retarder, the 5.0 weight sections were carried out for tricresyl phosphate, 4.0 weight sections combination of the thermostabilizer of the 7.0 weight sections and a dibutyltin maleate system was carried out for chlorinated polyethylene, and the resin constituent was prepared. And the transparent fire-resistant vinyl-chloride-resin plate with a thickness of 5mm was manufactured by producing calendered sheeting with a thickness of 0.5mm using this resin constituent, and pressing ten sheets of this calendered sheeting in piles.

[0200] About this transparent resin plate, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0201] the resin constituent prepared in the [example 25] example 24 -- as a decomposition accelerator - zinc stearate -- further -- 0.2 weight section combination was carried out and the transparent fire-resistant vinyl-chloride-resin plate with a thickness of 5mm was manufactured like the example 24 using this.

[0202] And total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like [plate / transparent / this / resin] examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0203] the resin constituent prepared in the [example 26] example 24 -- as a foaming agent -- a hydrazide compound -- further -- 0.3 weight section combination was carried out and the transparent fire-resistant vinyl-chloride-resin plate with a thickness of 5mm was manufactured like the example 24 using this.

[0204] And total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like [plate / transparent / this / resin] examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0205] While piling up six calendered sheeting produced using the resin constituent prepared in the [example 27] example 25, the transparent fire-resistant vinyl-chloride-resin plate (5mm in the whole thickness) of 3 layer structures which carried out the laminating unification of the surface layer with a thickness of 1mm was manufactured to vertical both sides of a core layer with a thickness of 3mm by pressing at a time in piles two calendered sheeting produced with the resin constituent of an example 26 in the vertical both sides.

[0206] About this transparent resin plate, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0207] To the general vinyl-chloride-resin (U-PVC) 100 weight section whenever [[example 28] chlorination / whose] is 56.4%, it considered as the zinc compound, and stearin acid was carried out as the 4.0 weight sections and lubricant, 1.0 weight section combination of the DOP was carried out [zinc stearate] for the stabilizer of the 0.2 weight section (when it converts into the amount of metal zinc, it is the 0.02 weight section), and a dibutyltin maleate system as the 0.5 weight section and a plasticizer, and the resin constituent was prepared.

[0208] And the transparent fire-resistant vinyl-chloride-resin plate of monolayer structure with a thickness of 5mm was manufactured by producing calendered sheeting with a thickness of 0.5mm and pressing ten sheets of this calendered sheeting in piles using this resin constituent.

[0209] About this transparent resin plate, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0210] To the back chlorinated-polyvinyl-chloride-resin (C-PVC) 100 weight section whenever [[example 29] chlorination / whose] is 64% of abbreviation, the thermostabilizer of the 7.0 weight

sections and a dibutyltin maleate system was carried out for tricresyl phosphate as a Lynn system flame retarder, 0.3 weight section combination of the hydrazide compound was carried out as the 4.0 weight sections and a foaming agent, and the resin constituent was prepared. And the transparent fire-resistant vinyl-chloride-resin plate with a thickness of 5mm was manufactured by producing calendered sheeting with a thickness of 0.5mm using this resin constituent, and pressing ten sheets of this calendered sheeting in piles.

[0211] About this transparent resin plate, total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0212] To the back chlorinated-polyvinyl-chloride-resin (C-PVC) 100 weight section whenever [[example 3 of comparison] chlorination / whose] is 64% of abbreviation, stearin acid was carried out for the stabilizer of a dibutyltin maleate system, 5.5 weight sections combination of the 1.5 weight section and the MBS system reinforcing agent was carried out for the 0.5 weight section and acrylic processing aid as the 4.0 weight sections and lubricant, and the resin constituent was prepared.

[0213] And while manufacturing the transparent vinyl-chloride-resin plate with a thickness of 5mm like the example 24 using this constituent and measuring that total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value, the fire-resistant test was performed. The result is shown in the following table 4.

[0214] Except having omitted the [example 4 of comparison] zinc stearate, the resin constituent was prepared like the example 28 and the transparent vinyl-chloride-resin plate with a thickness of 5mm was manufactured.

[0215] And total light transmission, diffused-light line permeability, parallel ray permeability, and the Hayes value were measured like [plate / this / resin] examples 15-18, and the fire-resistant test was performed further. The result is shown in the following table 4.

[0216]

[Table 4]

	実施例 24	実施例 25	実施例 26	実施例 27		実施例 28	実施例 29	比較例 3	比較例 4
				表面層	基層				
組成 (重量部)	C-PVC (塩素化度 64%)	100	100	100	100	—	100	100	—
	一般PVC (塩素化度 56%)	—	—	—	—	100	—	—	100
	ジブチル錫マレート系安定剤	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	ステアリン酸	—	—	—	—	0.5	—	0.5	0.5
	DOP	—	—	—	—	1.0	—	—	1.0
	アクリル系加工助剤	—	—	—	—	—	—	1.5	—
	MBS系補強剤	—	—	—	—	—	—	5.5	—
	塩素化ポリエチレン	7.0	7.0	7.0	7.0	—	—	—	—
	リン系難燃剤 (トリクレジル ホスフェート)	5.0	5.0	5.0	5.0	—	7.0	—	—
	分解促進剤 (ステアリン酸亜鉛)	—	0.2	—	—	0.2	—	—	—
難燃性テスト	発泡剤 (ヒドロジシド化合物)	—	—	0.3	—	—	0.3	—	—
	着火の有無	無	無	無	無	無	無	有	有
透 明 性	着火時間 (秒)	—	—	—	—	—	—	20	16
	全光線透過率 (%)	84.9	82.0	70.1	78.0	85.1	75.2	77.6	86.4
	拡散光線透過率 (%)	5.0	7.6	38.2	18.0	4.8	36.3	7.4	1.6
	平行光線透過率 (%)	79.9	74.4	31.9	60.0	80.3	38.9	70.2	84.8
	ヘイズ値 (%)	5.9	9.3	54.5	23.1	5.6	48.3	9.5	1.9

[0217] If the examples 24-27 and the example 3 of a comparison of Table 4 are contrasted, the resin plate of examples 24-27 Chlorinated polyethylene, The fire retardancy which was excellent with work of the Lynn system flame retarder, a decomposition accelerator, a foaming agent, etc. is demonstrated. The resin plate of the example 3 of a comparison which does not contain the above-mentioned chlorinated polyethylene, the Lynn system flame retarder, a decomposition accelerator, a foaming agent, etc. to the result that had set in the fire-resistant test and a gap did not light, either having been obtained In spite of using the high back chlorinated polyvinyl chloride resin (C-PVC) of whenever [same chlorination / as

examples 24-27], it is inferior to fire retardancy, and the result of lighting in 20 seconds was obtained. Thereby, it was proved that chlorinated polyethylene, the Lynn system flame retarder, a decomposition accelerator, a foaming agent, etc. were effective in fire-resistant grant.

[0218] Moreover, the resin plate of the example 29 which blended the foaming agent which is a flame retarder has the fire retardancy excellent only in having omitted chlorinated polyethylene and having blended the Lynn system flame retarder, and ignition was not seen. Thereby, when the flame retarder is blended, it turns out that either chlorinated polyethylene or the Lynn system flame retarder is omissible.

[0219] Moreover, in spite of using common vinyl chloride resin (U-PVC) with fire retardancy lower than back chlorinated polyvinyl chloride resin for the resin plate of an example 28 As opposed to the result of fire retardancy improving since zinc stearate is included as a zinc compound, and not lighting in a fire-resistant test having been obtained It was the result of saying that the resin plate which consists of common vinyl chloride resin which does not contain zinc stearate like the resin plate of the example 4 of a comparison is inferior to fire retardancy, and is further lit rather than the resin plate of the example 3 of a comparison for a short time.

[0220] Moreover, since the Hayes value rises, when using a foaming agent, it turns out that it is more desirable to make a surface layer contain a foaming agent like an example 27, and for that in which, as for each resin plate of examples 24-29, total light transmission contains a foaming agent like the resin plate of examples 26 and 29 although 70% or more and the Hayes value are 60% or less and have transparency to suppress the rise of the Hayes value.

[0221]

[Effect of the Invention] The effectiveness that the thing of fire retardancy of double layer structure also improves notably also as for the thing of monolayer structure, and, as for the fire-resistant vinyl chloride system resin Plastic solid of this invention, volume of smoke outbreak and the amount of generation of gas also decrease is done so, and a transparent Plastic solid has good transparency. And the Plastic solid of this invention has sufficient practical strength, and almost has neither chemical resistance nor a corrosion-resistant fall, and especially the thing of double layer structure has good chemical resistance and corrosion resistance on the front face of a Plastic solid, and does so various kinds of applications as which chemical resistance and fire retardancy are required, and the effectiveness that it can be suitably used as industrial use ingredients, such as semiconductor fabrication machines and equipment, especially.

[Translation done.]

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(54) 【発明の名称】 難燃性塩化ビニル系樹脂成形体

(57) 【要約】

【課題】 難燃性に優れ、発煙量やガス発生量が少なく、耐薬品性や耐蝕性が良好な難燃性塩化ビニル系樹脂成形体を提供する。

【解決手段】 塩化ビニル系樹脂に対し、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を難燃性付与成分として特定の割合で含有させるか、チタン化合物とこの難燃性付与成分を組合わせて含有させた難燃性塩化ビニル系樹脂成形体とする。透明な成形体の場合は、難燃性付与成分を含有させるか、リン系難燃剤や亜鉛化合物を含有させるか、これらを組合わせて含有させる。

【特許請求の範囲】

【請求項1】塩化ビニル系樹脂100重量部に対して、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめたことを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項2】塩化ビニル系樹脂100重量部に対して、発泡剤を0.0005～10重量部、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめたことを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項3】基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対して、発泡剤を0～10重量部含有せしめるか、又は、発泡剤を0～10重量部、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であることを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項4】基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩素化度が58%未満の塩化ビニル系樹脂100重量部に対して、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、表面層は、塩素化度が58%以上の塩化ビニル系樹脂の層であることを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項5】塩化ビニル系樹脂100重量部に対して、チタン化合物を5～50重量部、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめたことを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項6】更に、塩素捕獲化合物、無機質助剤の少なくともいずれか一種を2～30重量部含有せしめたことを特徴とする請求項1、請求項2、請求項5のいずれかに記載の難燃性塩化ビニル系樹脂成形体。

【請求項7】基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5～50重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対してチタン化合物を0～30重量部、発泡剤を0.0005～10重量部含有せしめた層であることを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項8】基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5～50重量部、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対し

て、チタン化合物を0～30重量部、発泡剤を0.0005～10重量部含有せしめた層であることを特徴とする難燃性塩化ビニル系樹脂成形体。

【請求項9】チタン化合物が酸化チタン又はチタン酸カリウムであることを特徴とする請求項5ないし請求項8のいずれかに記載の難燃性塩化ビニル系樹脂成形体。

【請求項10】塩化ビニル系樹脂100重量部に対して、チタン酸カリウムを5～50重量部含有せしめたことを特徴とする難燃性塩化ビニル系樹脂成形体。

10 【請求項11】塩素化度が略58～略73%の塩化ビニル系樹脂100重量部に対し、リン系難燃剤を0.5～15重量部、塩素化ポリエチレンを0.5～20重量部、錫系安定剤を0.5～7重量部含有せしめた、全光線透過率が50%以上、ヘイズ値が60%以下であることを特徴とする透明な難燃性塩化ビニル系樹脂成形体。

20 【請求項12】塩化ビニル系樹脂100重量部に対し、亜鉛化合物を金属亜鉛の量に換算して0.005～5重量部、錫系安定剤を0.5～7重量部含有せしめた、全光線透過率が40%以上、ヘイズ値が60%以下であることを特徴とする透明な難燃性塩化ビニル系樹脂成形体。

【請求項13】塩化ビニル系樹脂の塩素化度が略56%である請求項12に記載の透明な難燃性塩化ビニル系樹脂成形体。

【請求項14】更に、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめたことを特徴とする請求項11ないし請求項13のいずれかに記載の透明な難燃性塩化ビニル系樹脂成形体。

30 【請求項15】塩素化度が略58～略73%の塩化ビニル系樹脂100重量部に対し、リン系難燃剤又は塩素化ポリエチレンを0.5～15重量部、錫系安定剤を0.5～7重量部、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた、全光線透過率が40%以上、ヘイズ値が60%以下であることを特徴とする透明な難燃性塩化ビニル系樹脂成形体。

【発明の詳細な説明】

【0001】

40 【発明の属する技術分野】本発明は、優れた難燃性を有する塩化ビニル系樹脂成形体に関する。

【0002】

【従来の技術】塩化ビニル樹脂は成形性が良く、機械的強度が高く、安価であって、耐薬品性も良好であるため、工業用材料、特に耐食工業用材料として半導体製造装置をはじめ、あらゆる分野に広く利用されている。

【0003】かかる塩化ビニル樹脂は塩素を含むので、ある程度の難燃性を有しているが、火災が発生すると熱分解して煙や腐食性ガスを多量に出すため、この塩化ビニル樹脂の成形体を半導体製造装置等に用いると、火災

時に発生する煙や腐食性ガスによって製造施設内の空気が汚れ、製造装置類、機器類、半導体部品などが汚染されたり侵されたりする恐れがあった。このような事情から、更に高い難燃性を有する塩化ビニル樹脂の成形体が要求されるようになり、この要求を満足する塩化ビニル樹脂成形体の研究が行われている。

【0004】塩化ビニル樹脂成形体の難燃性を高めるには、従来から、多量の無機フィラーを含有させたり、ハロゲン系の難燃剤を含有させるなどの手段が主に採用されているが、このような手段を採用すると、以下に述べるような問題があった。

【0005】

【発明が解決しようとする課題】即ち、無機フィラーを多量に含有させる場合は、塩化ビニル樹脂成形体が脆弱化して実用強度を有する成形体を得ることが難しくなり、また、透明な成形体を得ることもできない上に、成形体の耐薬品性や耐蝕性が低下するという問題があった。

【0006】一方、ハロゲン系の難燃剤を含有させる場合は、成形体の難燃性を向上させることはできるが、火災時にハロゲンを含んだ腐食性ガスを多量に発生するという問題があり、また、透明な成形体にハロゲン系難燃剤を含有させると、透明性が大幅に低下するという問題があった。

【0007】本発明は、これらの問題を解決し得る優れた難燃性塩化ビニル系樹脂成形体の提供を目的とする。

【0008】

【課題を解決するための手段】前記目的を達成するため、本発明の請求項1に係る難燃性塩化ビニル系樹脂成形体は、塩化ビニル系樹脂100重量部に対して、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくとも一種を0.0005～10重量部含有せしめたことを特徴とする。

【0009】上記の発泡剤、分解促進剤、ラジカル発生剤、架橋剤を塩化ビニル系樹脂に含有させると難燃性が向上する理由については、次のように考えられる。

【0010】一般に、塩化ビニル系樹脂成形体に外部から過度の熱が加わると、塩化ビニル系樹脂中の塩素が熱により離脱して難燃作用を発揮すると共に、塩素の離脱した樹脂が熱分解して燃焼に至る。この燃焼に至る過程において、成形体に発泡剤が含有されていると、該発泡剤が熱分解により発泡して外部からの熱を遮断する作用をし、分解促進剤が含有されていると、該分解促進剤が塩化ビニル系樹脂の分解を促進して炭化を早める作用をし、ラジカル発生剤が含有されていると、発生するラジカルが塩化ビニル系樹脂の分解を促進して炭化を早める作用をし、架橋剤が含有されていると、該架橋剤が塩化ビニル系樹脂のポリマー分子と反応して高分子量化することによりガス化を抑制する作用をするため、塩化ビニル系樹脂成形体の難燃性が向上するものと考えられる。

【0011】次に、本発明の請求項2に係る難燃性塩化ビニル系樹脂成形体は、塩化ビニル系樹脂100重量部に対して、発泡剤を0.0005～10重量部、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめたことを特徴とする。

【0012】発泡剤は、燃焼に至る過程の初期の段階において発泡により外部からの熱を遮断するため、初期の燃焼を抑制する上で、他の分解促進剤、ラジカル発生剤、架橋剤よりも有効である。従って、この塩化ビニル系樹脂成形体のように発泡剤を必須成分とし、この発泡剤と他の分解促進剤、ラジカル発生剤、架橋剤のいずれかとを組合わせて含有させたものは、発泡剤の熱遮断作用によって初期の燃焼が充分抑制されると共に、その後は発泡剤の熱遮断作用と、分解促進剤、ラジカル発生剤又は架橋剤の前述した作用との相乗作用によって、優れた難燃性が発揮される。

【0013】次に、本発明の請求項3に係る難燃性塩化ビニル系樹脂成形体は、基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対して、発泡剤を0～10重量部含有せしめるか、又は、発泡剤を0～10重量部、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であることを特徴とする。

【0014】このような成形体は、表面層に発泡剤が単独で、又は、他の分解促進剤などと組合わせて含有されているため、燃焼に至る初期の段階で表面層に含まれる発泡剤の熱遮断作用により初期の優れた燃焼抑制効果が発揮されると共に、その後は発泡剤の熱遮断作用と、表面層や基層に含まれる分解促進剤、ラジカル発生剤又は架橋剤の前述した作用との相乗作用によって優れた難燃性が発揮される。また、表面層の発泡剤の分解で生じた気泡が、基層で発生する腐食性ガスをとらえるので、ガス放出量も少なくなる。

【0015】次に、本発明の請求項4に係る難燃性塩化ビニル系樹脂成形体は、基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩素化度が58%未満の塩化ビニル系樹脂100重量部に対して、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、表面層は、塩素化度が58%以上の塩化ビニル系樹脂の層であることを特徴とする。

【0016】塩化ビニル系樹脂の塩素化度と難燃性は正の相関関係があり、塩素化度が高くなるほど難燃性は向上する。従って、この成形体のように、塩素化度が58%以上と高い塩化ビニル系樹脂で表面層を形成すると、

発泡剤などの難燃性付与成分を全く含有させなくても表面層の難燃性が向上する。そのため、この成形体は、基層が発泡剤、分解促進剤、ラジカル発生剤、架橋剤のいずれかの含有によって難燃性が高められていることと相俟って、全体として優れた難燃性を発揮する。

【0017】以上の請求項1〜4に係る難燃性塩化ビニル系樹脂成形体は、いずれも無機フィラーを含有しないので、耐薬品性や耐蝕性が良好であり、また、脆弱化により強度低下を生じることもない。

【0018】尚、請求項1〜4の成形体において、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の含有量が請求項1〜4に記載された範囲を下回る場合は、成形体に十分な難燃性を付与することが困難になり、一方、請求項1〜4に記載された範囲を上回るように含有させても、それに見合った難燃性の更なる向上が見られないので、材料の無駄使いとなる。

【0019】次に、本発明の請求項5に係る難燃性塩化ビニル系樹脂成形体は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5〜50重量部、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005〜10重量部含有せしめたことを特徴とするものであって、チタン化合物としては、請求項9に記載されている酸化チタンやチタン酸カリウムなどが使用される。

【0020】酸化チタンなどのチタン化合物は熱分解温度がきわめて高く、その白色度や熱伝導率が高い粉末であるため、このようなチタン化合物が塩化ビニル系樹脂に含有されていると、燃焼に至る過程において、該チタン化合物が1200〜1300℃の高温まで分解することなく、その高い白色度によって外部からの熱を遮断する働き（熱遮断作用）をすると共に、塩素離脱後の樹脂の熱分解及び燃焼の段階では高い熱伝導率によって該樹脂をより速く炭化させる働き（炭化促進作用）をする。そして、このチタン化合物と共に発泡剤が含有されている場合は、該発泡剤の前述した熱遮断作用がチタン化合物の熱遮断作用に加わって一層優れた難燃性が発揮され、また、分解促進剤やラジカル発生剤が含有されている場合は、該分解促進剤や該ラジカル発生剤の前述した炭化促進作用がチタン化合物の炭化促進作用に加わって一層優れた難燃性が発揮され、更に、架橋剤が含有されている場合は、該架橋剤の前述したガス化抑制作用とチタン化合物の熱遮断作用及び炭化促進作用とが相乗して一層優れた難燃性が発揮される。

【0021】この請求項5の成形体において、チタン化合物の含有量が50重量部を越え、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の含有量が10重量部を越え、難燃性は顕著に向上するが、成形体の耐薬品性、強度、曲げ加工性などが低下する。一方、チタン化合物の含有量が5重量部を下回り、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の含有量が0.0005重

量部を下回ると、熱遮断作用や炭化促進作用が不十分となり、難燃性を向上させることが困難となる。

【0022】次に、本発明の請求項6に係る難燃性塩化ビニル系樹脂成形体は、上記請求項1、請求項2又は請求項5の成形体において、更に、塩素捕獲化合物、無機質助剤の少なくともいずれか一種を2〜30重量部含有せしめたことを特徴とする。

【0023】この成形体は、塩素捕獲化合物を含む場合は、燃焼時に塩素が塩素捕獲化合物によって捕獲されるため、塩素ガスや塩化水素ガスなどの腐食性ガスの発生量が更に減少し、また、無機質助剤を含む場合は、チタン化合物と無機質助剤が相乗して塩化ビニル系樹脂の炭化を一層促進するため、発煙量が更に減少して難燃性が一層向上する。

【0024】塩素捕獲化合物や無機質助剤の含有量が2重量部より少ない場合は、腐食性ガスや煙の発生量が多くなり減少せず、難燃性の更なる向上も難しくなる。一方、含有量が30重量部を越える場合は、成形体の耐薬品性、強度、曲げ加工性、成形性などが低下する。

【0025】次に、本発明の請求項7に係る難燃性塩化ビニル系樹脂成形体は、基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5〜50重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対してチタン化合物を0〜30重量部、発泡剤を0.0005〜10重量部含有せしめた層であることを特徴とする。

【0026】かかる成形体は、表面層のチタン化合物の含有量が30重量部以下と少ないので、成形体の表面が塩化ビニル系樹脂本来の良好な耐薬品性及び耐蝕性を有しており、しかも、この成形体の基層には熱遮断作用及び炭化促進作用を発揮するチタン化合物が5〜50重量部含有され、表面層には熱遮断作用を発揮する発泡剤が0.0005〜10重量部含有されているため、この成形体は全体として優れた難燃性を有している。そして、表面層の発泡剤の分解で生じた気泡が、基層で発生する腐食性ガスをとらえるので、ガス放出量も減少する。

【0027】次に、本発明の請求項8に係る難燃性塩化ビニル系樹脂成形体は、基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5〜50重量部、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005〜10重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対してチタン化合物を0〜30重量部、発泡剤を0.0005〜10重量部含有せしめた層であることを特徴とする。

【0028】かかる成形体も、表面層のチタン化合物の含有量が30重量部以下と少ないため、成形体の表面が塩化ビニル系樹脂本来の良好な耐薬品性及び耐蝕性を有

している。しかも、基層は、熱遮断作用及び炭化促進作用を発揮するチタン化合物と共に、炭化促進作用を発揮する分解促進剤やラジカル発生剤や架橋剤が含有されているため難燃性に優れており、この基層で発生する腐食性ガスを、表面層の発泡剤の分解により生じた気泡でとらえてガス放出量を抑制する。従って、この成形体は全体として優れた難燃性を有している。

【0029】次に、本発明の請求項10に係る難燃性塩化ビニル系樹脂成形体は、塩化ビニル系樹脂100重量部に対して、チタン酸カリウムを5〜50重量部含有せしめたことを特徴とするものである。

【0030】この成形体のように、チタン化合物であるチタン酸カリウムを5〜50重量部含有させるだけでも、火災時にチタン酸カリウムが熱遮断作用と炭化促進作用を発揮するため、難燃性が向上し、煙や腐食性ガスの発生量が減少する。

【0031】次に、本発明の請求項11に係る透明な難燃性塩化ビニル系樹脂成形体は、塩素化度が略58〜略73%の塩化ビニル系樹脂100重量部に対し、リン系難燃剤を0.5〜15重量部、塩素化ポリエチレンを0.5〜20重量部、錫系安定剤を0.5〜7重量部含有せしめた、全光線透過率が50%以上、ヘイズ値が60%以下の成形体であることを特徴とする。

【0032】この難燃性塩化ビニル系樹脂成形体によれば、燃焼時にリン系難燃剤が酸化ないし熱分解してリン酸を生成し、該リン酸が塩化ビニル系樹脂の表面に残留して酸素移動を妨げると共に、表面の炭化を促進して燃焼を抑制する作用を発揮する。そして、塩素化ポリエチレンは熱分解により塩素ガスを発生して燃焼を遅らせる作用をし、塩素化度の高い塩化ビニル系樹脂も熱分解により多量の塩素ガスを発生して燃焼を遅らせる。そのため、この塩化ビニル系樹脂成形体は難燃性に優れ、発煙量が少ない。

【0033】また、この塩化ビニル系樹脂成形体のようにリン系難燃剤を含有させると、ハロゲン系難燃剤を含有させる場合に比べて透明性が向上し、上記のように50%以上の全光線透過率と、60%以下のヘイズ値を有する成形体を得られる。錫系安定剤は透明な塩化ビニル系樹脂成形体を得るために不可欠な熱安定剤であり、鉛系安定剤を添加しても透明な成形体を得ることは困難である。なお、上記の全光線透過率とヘイズ値は、成形体の厚さが5mmのときの値である。

【0034】リン系難燃剤と塩素化ポリエチレンの含有量が塩化ビニル系樹脂100重量部に対してそれぞれ0.5重量部より少なくなると、成形体に十分な難燃性を付与することが困難となる。一方、リン系難燃剤の含有量が15重量部より多くなると、該難燃剤がブリードアウトするようになり、また、塩素化ポリエチレンの含有量が20重量部より多くなると、透明性が低下する。更に、塩素化度が58%より低い塩化ビニル系樹脂を用

いると、難燃性を向上させる上で不利となり、また、塩素化度が73%より高い塩化ビニル系樹脂は、熱安定性、成形性、耐薬品性、耐蝕性等が悪いので不適当である。

【0035】次に、本発明の請求項12に係る透明な難燃性塩化ビニル系樹脂成形体は、透明な塩化ビニル系樹脂100重量部に対し、亜鉛化合物を金属亜鉛の量に換算して0.005〜5重量部、錫系安定剤を0.5〜7重量部含有せしめた、全光線透過率が40%以上、ヘイズ値が60%以下の成形体であることを特徴とする。

【0036】この成形体のように亜鉛化合物を含有させると、燃焼時に亜鉛化合物の樹脂分解促進作用により塩化ビニル樹脂の炭化が促進されるため、難燃性が向上する。亜鉛化合物の含有量が金属亜鉛の量に換算して0.005重量部より少なくなると、成形体に十分な難燃性を付与することが困難となり、一方、5重量部より多くなると、透明性が悪くなる。なお、上記の全光線透過率とヘイズ値は、成形体の厚さが5mmのときの値である。

【0037】次に、本発明の請求項13に係る透明な難燃性塩化ビニル系樹脂成形体は、上記請求項12の成形体において、塩化ビニル系樹脂の塩素化度が略56%であることを特徴とする。

【0038】この成形体のように、塩素化度が略56%の塩化ビニル系樹脂を用いると、耐薬品性が良好で難燃性を有する成形体とすることができる。

【0039】次に、本発明の請求項14に係る難燃性塩化ビニル系樹脂成形体は、上記請求項11ないし請求項13のいずれかの成形体において、更に発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005〜10重量部含有せしめたことを特徴とするものである。

【0040】このような成形体は、発泡剤の前述した熱遮断作用、分解促進剤やラジカル発生剤の前述した炭化促進作用、架橋剤の前述したガス化抑制作用によって、難燃性が更に高められる。これらの含有量が0.0005重量部より少なくなると、難燃性を更に向上させることが難しくなり、一方、10重量部より多量に含有させても、それに見合った難燃性向上効果が得られないので無駄となる。

【0041】次に、本発明の請求項15に係る難燃性塩化ビニル系樹脂成形体は、塩素化度が略58〜略73%の塩化ビニル系樹脂100重量部に対し、リン系難燃剤又は塩素化ポリエチレンを0.5〜15重量部、錫系安定剤を0.5〜7重量部、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005〜10重量部含有せしめた、全光線透過率が40%以上、ヘイズ値が60%以下の成形体であることを特徴とする。

【0042】この成形体のように発泡剤等の難燃性付与

成分を配合する場合は、難燃性付与成分によって成形体の難燃性が高められるので、前記請求項11の成形体のようにリン系難燃剤と塩素化ポリエチレンの双方を含有させる必要がなくなり、リン系難燃剤と塩素化ポリエチレンのどちらか一方を含有させるだけで、優れた難燃性を付与することが可能となる。尚、この成形体に配合されるリン系難燃剤、塩素化ポリエチレン、錫系安定剤等の作用は、前記請求項11の成形体のところで説明した通りである。

【0043】

【発明の実施の形態】以下、本発明の具体的な実施形態を詳述する。

【0044】本発明の難燃性塩化ビニル系樹脂成形体は、①発泡剤、分解促進剤、ラジカル発生剤、架橋剤（以下、これらをまとめて難燃性付与成分という）のいずれかを含み、チタン化合物やリン系難燃剤や亜鉛化合物を含まない成形体A、②難燃性付与成分のいずれかとチタン化合物を含む成形体B、③チタン化合物を含み、難燃性付与成分を含まない成形体C、④リン系難燃剤又は亜鉛化合物又は塩素化ポリエチレンと好ましくは難燃性付与成分のいずれかを含む透明な成形体Dに大別される。

【0045】成形体Aの主な実施形態としては、以下に述べる単層構造の成形体A₁、A₂、A₃、A₄、A₅、と、複層構造の成形体A₆、A₇が挙げられる。

【0046】成形体A₁は、塩化ビニル系樹脂100重量部に対して、難燃性付与成分のうち発泡剤を0.0005～10重量部含有せしめた単層構造の成形体であり、この成形体A₁には、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。鉛系の安定剤は不透明な成形体を得る場合に使用され、錫系の安定剤は透明な成形体を得る場合に使用される。

【0047】塩化ビニル系樹脂としては、(a)塩素化度が約56%の一般の塩化ビニル樹脂、(b)塩素化度が略58～略73%の後塩素化塩化ビニル樹脂、(c)これらの塩化ビニル樹脂を混合した樹脂、(d)これらの塩化ビニル樹脂に酢酸ビニル樹脂やアクリル樹脂等を混合した樹脂、(e)塩化ビニルと酢酸ビニルやエチレン等との共重合樹脂、などが使用される。

【0048】(a)の一般の塩化ビニル樹脂は耐薬品性に優れた成形体A₁を得る場合に特に有効であり、

(b)の後塩素化塩化ビニル樹脂は難燃性に優れた成形体A₁を得る場合に特に有効であり、(c)の混合樹脂は耐薬品性と難燃性のバランスが良い成形体A₁を得る場合に特に有効であり、(d)の混合樹脂や(e)の共重合樹脂は成形性や曲げ加工性等の物性を改善した成形体A₁を得る場合に特に有効である。(c)(d)

(e)の樹脂は、その平均塩素化度を約50～約73%となるように混合したり、共重合させることによって、

難燃性を保つようにしておく必要がある。

【0049】この塩化ビニル系樹脂に含有される発泡剤としては、塩化ビニル系樹脂の成形加工温度より高い200℃以上の温度で発泡を開始するものが適しており、例えば、アゾジカルボンアミド、アゾビスイソブチロニトリル、ジニトロソペンタメチレンテトラミン、ヒドラジド化合物（例えばパラトルエンスルホニルヒドラジド、4,4'-オキシビスベンゼンスルホニルヒドラジド等）、無機炭酸塩と有機酸との混合物などが好ましく使用される。

【0050】このような発泡剤を塩化ビニル系樹脂に含有せしめた単層構造の成形体A₁は、成形時や曲げ加工時には発泡することがなく、火災時に発泡温度以上に加熱されると発泡剤が発泡して優れた熱遮断作用を発揮するため、成形体A₁の難燃性が大幅に向上する。そして、気泡内に煙や腐食性ガスを取り込むため、発煙量や腐食性ガス発生量を減少させることもできる。

【0051】発泡剤の含有量は、塩化ビニル系樹脂100重量部に対して0.0005～10重量部とすることが必要であって、0.0005重量部未満では熱遮断作用が不足するため成形体に十分な難燃性を付与することが難しくなり、一方、10重量部より多量に含有させても、それに見合った難燃性向上効果がみられないので発泡剤の無駄使いとなる。発泡剤の更に好ましい含有量は、0.05～5重量部である。

【0052】この成形体A₁は、上記のように優れた難燃性を有することに加えて、無機フィラーを含まないため耐薬品性や耐蝕性が良好であり、脆弱化によって強度が低下することもない。

【0053】次に、成形体A₂は、塩化ビニル系樹脂100重量部に対して、難燃性付与成分のうち分解促進剤を0.0005～10重量部含有せしめた単層構造の成形体であり、この成形体A₂にも、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0054】分解促進剤としては、塩化ビニル系樹脂の成形加工温度より高い200℃以上の温度で塩化ビニル系樹脂の分解を促進するものが適しており、その中でも亜鉛化合物（例えばラウリン酸亜鉛、ステアリン酸亜鉛、安息香酸亜鉛等の亜鉛石鹸）、アミン化合物（例えばメラミン、トリエチルアミン等）、水酸化鉄などが好ましく使用される。尚、塩化ビニル系樹脂は、前述の成形体A₁で用いたものと同じものが使用される。

【0055】このような分解促進剤を塩化ビニル系樹脂に含有せしめた成形体A₂は、成形時や曲げ加工時に分解促進剤によって塩化ビニル系樹脂が分解されることはないが、火災時の燃焼に至る過程においては、分解促進剤により塩化ビニル系樹脂の分解が促進されて炭化が早められるため、優れた難燃性を発揮することができる。

【0056】分解促進剤の含有量は、塩化ビニル系樹脂

100重量部に対して0.0005~10重量部とすることが必要であって、0.0005重量部未満では炭化促進作用が不足するため成形体に十分な難燃性を付与することが難しくなり、一方、10重量部より多量に含有させても、それに見合った難燃性向上効果がみられないので分解促進剤の無駄使いとなる。分解促進剤の更に好ましい含有量は0.05~5重量部である。

【0057】次に、成形体A₃は、塩化ビニル系樹脂100重量部に対して、難燃性付与成分のうちラジカル発生剤を0.0005~10重量部含有せしめた単層構造の成形体であり、この成形体A₃にも、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0058】ラジカル発生剤としては、塩化ビニル系樹脂の成形加工温度より高い200℃以上の温度でラジカルを発生させるものが適しており、例えば、ジアミルパーオキサイド、パーオキシジカーボネート、ジアルキルパーオキサイド、ハイドロパーオキサイド等の過氧化物や、過塩素酸塩などが好ましく使用される。尚、塩化ビニル系樹脂は、前述の成形体A₁で用いたものと同じものが使用される。

【0059】上記のように高温で作用するラジカル発生剤を塩化ビニル系樹脂に含有せしめた成形体A₃は、成形時や加工時にはラジカルが発生しないので劣化の恐れはないが、火災時の燃焼に至る過程においては、ラジカル発生剤によって発生するラジカルが塩化ビニル系樹脂の分解を促進して炭化を早めるため、優れた難燃性を発揮することができる。

【0060】ラジカル発生剤の含有量は、塩化ビニル系樹脂100重量部に対して0.0005~10重量部とすることが必要であって、0.0005重量部未満では炭化促進作用が不足するため成形体に十分な難燃性を付与することが難しくなり、一方、10重量部より多量に含有させても、それに見合った難燃性向上効果がみられないのでラジカル発生剤の無駄使いとなる。ラジカル発生剤の更に好ましい含有量は0.05~5重量部である。

【0061】次に、成形体A₄は、塩化ビニル系樹脂100重量部に対して、難燃性付与成分のうち架橋剤を0.0005~10重量部含有せしめた単層構造の成形体であり、この成形体A₄にも、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0062】架橋剤としては、塩化ビニル系樹脂の成形加工温度より高い200℃以上の温度で架橋を開始するものが適しており、例えばトリアジンチオール化合物などが好ましく使用される。尚、塩化ビニル系樹脂は、前述の成形体A₁で用いたものと同じものが使用される。

【0063】このように高温で作用する架橋剤を塩化ビニル系樹脂に含有させた成形体A₄は、成形時や加工時

には架橋反応が生じないので種々の形状に成形又は二次加工することができる。そして、火災時の燃焼に至る過程においては、架橋反応によって塩化ビニル系樹脂のポリマー分子が高分子量化され、耐熱性が高められると共にガス化し難くなるため、優れた難燃性が発揮される。

【0064】架橋剤の含有量は、塩化ビニル系樹脂100重量部に対して0.0005~10重量部とすることが必要であって、0.0005重量部未満では高分子量化やガス化抑制作用が不足するため成形体に十分な難燃性を付与することが難しくなり、一方、10重量部より多量に含有させても、それに見合った難燃性向上効果がみられないので架橋剤の無駄使いとなる。架橋剤の更に好ましい含有量は0.05~5重量部である。

【0065】上記の成形体A₁~A₄は、塩化ビニル系樹脂に対して難燃性付与成分のいずれか一種を含有させたものであるが、難燃性付与成分のいずれか二種以上を含有させてもよい。その場合は、次に述べる成形体A₅のように発泡剤を必須成分とし、この発泡剤と他の難燃性付与成分を組合わせて含有させることが望ましい。

【0066】即ち、成形体A₅は、塩化ビニル系樹脂100重量部に対して、発泡剤を0.0005~10重量部、他の難燃性付与成分である分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005~10重量部含有せしめた単層構造の成形体であって、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合されたものである。

【0067】塩化ビニル系樹脂や、難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤は、前述の成形体A₁~A₄に用いたものと同じものが使用される。

【0068】発泡剤は、燃焼に至る過程の初期の段階において発泡により外部からの熱を遮断するため、初期の燃焼を抑制する上で他の難燃性付与成分よりも有効である。従って、この発泡剤を必須とし、他の難燃性付与成分の一種以上と組合わせて含有させた上記の成形体A₅は、発泡剤の熱遮断作用によって初期の燃焼が充分抑制されると共に、その後は発泡剤の熱遮断作用と、他の難燃性付与成分の前述した炭化促進作用やガス化抑制作用との相乗作用によって、優れた難燃性が発揮される。そして、発泡剤の分解で生じた気泡が、発生する煙や腐食性ガスをとらえるので、発煙量やガス放出量も少なくなる。

【0069】発泡剤の含有量及び他の難燃性付与成分の含有量は、0.0005~10重量部とすることが必要であって、これより少なくすると十分な難燃性を付与することが難しくなり、逆に、これより多くしても、それに見合った難燃性向上効果が得られないので難燃性付与成分の無駄使いとなる。発泡剤及び他の難燃性付与成分の更に好ましい含有量は、0.05~5重量部である。

【0070】以上説明した単層構造の難燃性塩化ビニル

系樹脂成形体A₁～A₅は、難燃性付与成分や添加剤を選択して配合した塩化ビニル系樹脂組成物を、押出成形、カレンダープレス、射出成形、その他の公知の成形技術によって、平板やパイプや丸棒やアングルや他の異形品など所望の形状に成形して得られるものである。このような成形体は、そのまま、或は、更に二次加工して、難燃性が要求される各種用途に用いられる。

【0071】次に、複層構造の成形体A₆は、基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、難燃性付与成分のうち分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対して、発泡剤を0～10重量部含有せしめるか、又は、発泡剤を0～10重量部と、他の難燃性付与成分である分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層からなるものである。この成形体A₆の基層や表面層にも、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0072】また、塩化ビニル系樹脂や、難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤は、前述の成形体A₁～A₄に用いたものと同じものが使用される。

【0073】このような複層構造の成形体A₆は、燃焼に至る初期の段階で表面層に含まれる発泡剤の熱遮断作用により初期の優れた燃焼抑制効果が発揮されると共に、その後は発泡剤の熱遮断作用と、表面層や基層に含まれる他の難燃性付与成分の炭化促進作用やガス化抑制作用との相乗作用によって、優れた難燃性が発揮される。そして、表面層の発泡剤の分解で生じた気泡が、基層で発生する煙や腐食性ガスをとらえるので、発煙量やガス放出量も少なくなる。

【0074】基層の難燃性付与成分である分解促進剤、ラジカル発生剤、架橋剤の含有量、及び、表面層の発泡剤や他の難燃性付与成分の含有量は、上記の範囲内とすることが必要であって、基層の難燃性付与成分の含有量が0.0005重量部より少なくなり、表面層の発泡剤の含有量が0重量部、他の難燃性付与成分の含有量が0.0005重量部より少なくなると、充分な難燃性を成形体A₆に付与することが難しくなる。一方、基層の難燃性付与成分の含有量が10重量部を越え、表面層の発泡剤や他の難燃性付与成分の含有量が10重量部を越えても、それに見合った難燃性向上効果が得られないので難燃性付与成分の無駄使いとなる。基層における難燃性付与成分の更に好ましい含有量は0.05～5重量部であり、表面層における発泡剤と他の難燃性付与成分の更に好ましい含有量は、0～5重量部と0.05～5重量部である。

【0075】もう一つの複層構造の成形体A₇は、その基層が、58%未満の塩素化度を有する塩化ビニル系樹脂100重量部に対して、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005～10重量部含有せしめた層であり、該基層の少なくとも片面に積層一体化した表面層が、58%以上の塩素化度を有する塩化ビニル系樹脂の層からなるものである。この成形体A₇の基層や表面層にも、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0076】基層の塩化ビニル系樹脂としては、前述した塩素化度が約56%の一般の塩化ビニル樹脂が好適に使用される。そして、表面層の塩化ビニル系樹脂としては、前述した塩素化度が略58～略73%の後塩素化塩化ビニル樹脂が好適に使用され、更にはこの後塩素化塩化ビニル樹脂に一般の塩化ビニル樹脂、酢酸ビニル樹脂、アクリル樹脂、塩化ビニル-酢酸ビニル共重合樹脂等を混合した平均塩素化度が58%以上の混合樹脂も使用される。また、発泡剤、分解促進剤、ラジカル発生剤、架橋剤は、前述の成形体A₂～A₄に用いたものと同じものが使用される。

【0077】塩化ビニル系樹脂の塩素化度と難燃性は正の相関関係があり、塩素化度が高くなるほど難燃性は向上するため、上記のように塩素化度が58%以上と高い塩化ビニル系樹脂で表面層を形成すると、発泡剤などの難燃性付与成分を全く含有させなくても表面層の難燃性が向上する。そのため、この複層構造の成形体A₇は、基層に発泡剤、分解促進剤、ラジカル発生剤、架橋剤のいずれかを含有させるだけで、全体として優れた難燃性を付与することができる。

【0078】基層の難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤の含有量は0.0005～10重量部とすることが必要であって、0.0005重量部より少なくなると充分な難燃性を付与することが難しくなり、一方、10重量部より多量に含有させてもそれに見合った難燃性向上効果が得られないので難燃性付与成分の無駄使いとなる。基層における難燃性付与成分の更に好ましい含有量は、0.05～5重量部である。

【0079】上記複層構造の成形体A₆、A₇は、難燃性付与成分と他の添加剤を選択して配合した基層形成用の塩化ビニル系樹脂組成物と、難燃性付与成分と他の添加剤を選択して配合した表面層形成用の塩化ビニル系樹脂組成物、又は、難燃性付与成分を含まない表面層形成用の塩化ビニル系樹脂組成物を調製し、これらの組成物を多層押出成形、カレンダープレス、ラミネートその他の手段によって所望の形状に積層成形して製造されるものであり、そのまま、或は、二次加工して、難燃性が要求される各種用途に使用される。

【0080】次に、難燃性付与成分のいずれかとチタン

化合物を含んだ塩化ビニル系樹脂成形体Bについて説明する。この成形体Bの主な実施形態としては、以下に述べる単層構造の成形体B₁、B₂、B₃、B₄と、複層構造の成形体B₅、B₆が挙げられる。

【0081】成形体B₁は、塩化ビニル樹脂100重量部に対して、チタン化合物を5〜50重量部、難燃性付与成分のうち発泡剤を0.0005〜10重量部含有せしめた単層構造の成形体であり、この成形体B₁には、成形に必要な鉛系又は錫系の安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0082】チタン化合物としては、酸化チタンやチタン酸カリウム等が使用され、特に、0.1〜0.5 μ m程度の平均粒径を有する粉体が好ましく使用される。このような平均粒径を有する酸化チタンやチタン酸カリウムの粉体は、塩化ビニル系樹脂との混練性が良く、均一な分散状態で含有させることができる。また、表面をアルミナで被覆した酸化チタンは、燃焼時に酸化チタンとアルミナの相乗作用によって塩化ビニル系樹脂の炭化が更に促進されると共に、アルミナによって煙やガスが吸着される利点を有するので、極めて好ましく使用される。

【0083】尚、塩化ビニル系樹脂や発泡剤は、前述の成形体A₁で用いたものと同じものが使用される。

【0084】この成形体B₁のようにチタン化合物と発泡剤が含有されていると、有機物である塩化ビニル系樹脂の量が相対的に減少し、既述したように、燃焼に至る過程においてチタン化合物により熱遮断作用と炭化促進作用が発揮されると共に、発泡剤によっても熱遮断作用やガス捕獲作用が発揮されるため、成形体B₁の難燃性が向上し、発煙量や腐食性ガスの発生量が減少する。また、発泡剤として成形加工温度より高い200℃以上の温度で発泡を開始するものを用いると、成形時に発泡せず硬質の成形体を得ることができ、曲げ等の二次加工時にも発泡する心配がない。

【0085】チタン化合物の含有量は、塩化ビニル樹脂100重量部に対して5〜50重量部とする必要があり、発泡剤の含有量は0.0005〜10重量部とする必要がある。チタン化合物の含有量が50重量部を越え、発泡剤の含有量が10重量部を越えると、難燃性は顕著に向上するが、成形体B₁の耐薬品性、強度、曲げ加工性などが低下する。一方、チタン化合物の含有量が50重量部を下回り、発泡剤の含有量が0.0005重量部を下回ると、熱遮断作用や炭化促進作用が不十分となって、難燃性を向上させることが困難となる。チタン化合物の更に好ましい含有量は8〜30重量部、発泡剤の更に好ましい含有量は0.05〜10重量部である。

【0086】次に、成形体B₂は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5〜50重量部、分解促進剤を0.0005〜10重量部含有せしめた単層構造の成形体であり、この成形体B₂にも、成形に必

要な鉛系又は錫系安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0087】チタン化合物は上述の成形体B₁に用いたものと同じものが使用され、また、塩化ビニル系樹脂や分解促進剤は、前述の成形体A₁、A₂に用いたものと同じものが使用される。

【0088】この成形体B₂のようにチタン化合物と分解促進剤が含有されていると、チタン化合物の熱遮断作用と炭化促進作用により難燃性が向上することに加えて、燃焼時に分解促進剤により塩化ビニル系樹脂の分解が促進されて炭化が更に早められるため、優れた難燃性が発揮される。また、分解促進剤として200℃以上の高温で作用するものを使用すると、成形時や曲げ等の二次加工時に分解促進剤による塩化ビニル系樹脂の分解が生じず、強度のある成形体や曲げ加工体が得られる。

【0089】チタン化合物の含有量は、前記成形体B₁の場合と同様、塩化ビニル樹脂100重量部に対して5〜50重量部とする必要があり、分解促進剤の含有量も同様に0.0005〜10重量部とする必要がある。その理由は前記成形体B₁の場合と同様であるので説明を省略する。尚、チタン化合物の更に好ましい含有量は8〜30重量部、分解促進剤の更に好ましい含有量は0.0005〜5重量部である。

【0090】次に、成形体B₃は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5〜50重量部、ラジカル発生剤を0.0005〜10重量部含有せしめた単層構造の成形体であり、この成形体B₃にも、成形に必要な鉛系又は錫系安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0091】そして、チタン化合物は前述の成形体B₁に用いたものと同じものが使用され、また、塩化ビニル系樹脂やラジカル発生剤は、前述の成形体A₁、A₃に用いたものと同じものが使用される。

【0092】この成形体B₃のようにチタン化合物とラジカル発生剤を含有させると、チタン化合物の熱遮断作用と炭化促進作用により難燃性が向上することに加えて、燃焼時にラジカル発生剤によってラジカルが発生し、塩化ビニル系樹脂の分解が促進されて炭化が更に早められるため、優れた難燃性が発揮される。また、ラジカル発生剤として200℃以上の高温で作用するものを用いると、成形時や二次加工時にラジカルを発生させることがないので、成形時や二次加工時における塩化ビニル系樹脂の劣化がなく、強度のある成形品や二次成形品を得ることができる。

【0093】チタン化合物の含有量は、前記成形体B₁の場合と同様、塩化ビニル樹脂100重量部に対して5〜50重量部とする必要があり、ラジカル発生剤の含有量も同様に0.0005〜10重量部とする必要がある。その理由は前記成形体B₁の場合と同様であるので説明を省略する。尚、チタン化合物の更に好ましい含有

量は8〜30重量部、ラジカル発生剤の更に好ましい含有量は0.0005〜5重量部である。

【0094】次に、成形体B₄は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5〜50重量部、架橋剤を0.0005〜10重量部含有せしめた単層構造の成形体であり、この成形体B₄にも、成形に必要な鉛系又は錫系安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0095】そして、チタン化合物は前述の成形体B₁に用いたものと同じものが使用され、また、塩化ビニル系樹脂や架橋剤は、前述の成形体A₁、A₄に用いたものと同じものが使用される。

【0096】この成形体B₄のようにチタン化合物と架橋剤を含有させると、チタン化合物の熱遮断作用と炭化促進作用により難燃性が向上することに加えて、外部からの熱と架橋剤の作用により樹脂が高分子量化され、耐熱性が高められると共にガス化し難くなるため、優れた難燃性が発揮される。また、架橋剤として200℃以上の高温で作用するものを用いると、成形時には架橋反応を生じないため、得られる成形体は従来と同様の良好な成形性を有し、種々の形状に二次加工できる。

【0097】チタン化合物の含有量は、前記成形体B₁の場合と同様、塩化ビニル樹脂100重量部に対して5〜50重量部とする必要があり、架橋剤の含有量も同様、0.0005〜10重量部とする必要がある。その理由は前記成形体Aの場合と同様であるので説明を省略する。尚、チタン化合物の更に好ましい含有量は8〜30重量部、架橋剤の更に好ましい含有量は0.05〜5重量部である。

【0098】以上の成形体B₁、B₂、B₃、B₄においては、更に、塩素捕獲化合物又は無機質助剤の少なくともいずれか一種を2〜30重量部含有させてもよい。塩素捕獲化合物を含有させると、燃焼時に塩素が塩素捕獲化合物によって捕獲されるため、塩素ガスや塩化水素ガスなどの腐食性ガスの発生量が更に減少し、また、無機質助剤を含有させると、チタン化合物と無機質助剤が相乗して塩化ビニル系樹脂の炭化を一層促進するため、発煙量が更に減少して難燃性が一層向上する。

【0099】塩素捕獲化合物としては、炭酸カルシウム、炭酸リチウム、炭酸マグネシウムなどの炭酸塩が好適であり、特に、平均粒径が0.5μm以下、好ましくは0.1μm以下の炭酸塩の粉体は、比表面積が大きく塩素と反応しやすいので極めて好適に使用される。その他、錫化合物、ゼオライト、硫酸バリウム、チタン酸カリウム、ナトリウム化合物、マグネシウム化合物、アルミニウム化合物、リチウム化合物なども使用される。

【0100】また、無機質助剤としては、シリカ、アルミナ、珪酸アルミニウム、タルクなどが単独で又は二種以上混合して使用される。

【0101】塩素捕獲化合物や無機質助剤の含有量は2

〜30重量部とする必要があり、2重量部より少ない場合は、腐食性ガスや煙の発生量があまり減少せず、難燃性の更なる向上も難しくなる。一方、含有量が30重量部を越える場合は、成形体の耐薬品性、強度、曲げ加工性、成形性などが低下する。塩素捕獲化合物の更に好ましい含有量は7〜20重量部であり、無機質助剤の更に好ましい含有量は2〜15重量部である。

【0102】尚、上記の塩素捕獲化合物又は無機質助剤を前述した単層構造の成形体A₁〜A₅に同様に2〜30重量部含有させて難燃性を更に向上させるようにしてもよく、また、前述した複層構造の成形体A₆、A₇の基層に含有させてもよい。

【0103】以上説明した単層構造の成形体B₁、B₂、B₃、B₄や、これらに塩素捕獲化合物又は無機質助剤を更に含有させた成形体は、チタン化合物、発泡剤、架橋剤、ラジカル発生剤、分解促進剤、塩素捕獲化合物、無機質助剤、その他の添加剤等を選択して配合した塩化ビニル系樹脂組成物を、押出成形、カレンダープレス、射出成形、その他の公知の成形技術によって、平板その他の所望の形状に成形して得られるものである。このような成形体は、そのまま、或は、更に二次加工して容器等を製作し、各種用途、特に半導体製造装置などに好適に用いられる。

【0104】次に、複層構造の成形体B₅は、その基層が塩化ビニル系樹脂100重量部に対してチタン化合物を5〜50重量部含有せしめた層であり、該基層の少なくとも片面に積層一体化した表面層が、塩化ビニル系樹脂100重量部に対してチタン化合物を0〜30重量部、発泡剤を0.0005〜10重量部含有せしめた層よりなるものである。表面層のチタン化合物の含有量は、基層のそれより少なく含有させることが好ましい。

【0105】塩化ビニル系樹脂、チタン化合物、発泡剤は、前記成形体B₁で用いたものと同じものが使用され、また、基層と表面層には、成形に必要な鉛系又は錫系安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。

【0106】上記の表面層は、成形体B₅の表面の物性、特に耐薬品性や耐蝕性の低下を抑えるためのものであるから、基層の両面に形成することが望ましいが、基層の片面にのみ形成されていてもよく、その厚みは0.4〜1.1mm程度あれば充分である。

【0107】このような複層構造の成形体B₅は、表面層のチタン化合物の含有量が30重量部以下と少ないので、成形体B₅の表面が塩化ビニル系樹脂本来の良好な耐薬品性及び耐蝕性を有し、表面層は脆弱化することがない。しかも、この成形体の基層には、熱遮断作用及び炭化促進作用を発揮するチタン化合物が5〜50重量部含有され、表面層には熱遮断作用及びガス捕獲作用を発揮する発泡剤が0.0005〜10重量部含有されているため、この成形体B₅は全体として優れた難燃性を有

している。

【0108】表面層のチタン化合物の含有量が30重量部を越えると、表面層の難燃性は向上するが、表面層の塩化ビニル系樹脂量が少なくなりすぎて、塩化ビニル系樹脂本来の良好な耐薬品性、耐蝕性を維持できなくなり、また、表面層の強度も低下するので、上記のようにチタン化合物の含有量は30重量部以下とする必要がある。チタン化合物の含有量は零とすることも可能であるが、このときは表面層の厚みを薄くし且つ基層の酸化チタンの含有量を多くすればよい。

【0109】更に、表面層の発泡剤の含有量が0.0005重量部より少なくなると、発泡による熱遮断作用やガス捕獲作用が不十分となり、逆に10重量部より多くなると、表面層の耐薬品性や耐蝕性が低下すると共に強度も低下するため、上記のように表面層の発泡剤の含有量は0.0005~10重量部とする必要がある。なお、表面層のチタン化合物の更に好ましい含有量は3~15重量部であり、発泡剤の更に好ましい含有量は0.05~10重量部である。

【0110】また、基層のチタン化合物の含有量が5重量部より少なくなると難燃性を向上させることが難しくなり、50重量部より多量に含有させると基層の強度、曲げ加工性などが低下するため、上記のように基層におけるチタン化合物の含有量は5~50重量部とする必要がある。

【0111】この成形体B₅においては、特に表面層のチタン化合物の含有量を基層のそれより少なくすることで、チタン化合物の耐薬品性への影響を極力抑え、基層で難燃性を向上させることが好ましい。そのため、表面層にチタン化合物を3~15重量部、基層に15~35重量部含有させるのが好ましく採用される。

【0112】次に、複層構造の成形体B₆は、基層の少なくとも片面に表面層を積層一体化した成形体であって、基層は、塩化ビニル系樹脂100重量部に対して、チタン化合物を5~50重量部、ラジカル発生剤、分解促進剤の少なくともいずれか一種を0.0005~10重量部含有せしめた層であり、表面層は、塩化ビニル系樹脂100重量部に対してチタン化合物を0~30重量部、発泡剤を0.0005~10重量部含有せしめた層よりなるものである。

【0113】塩化ビニル系樹脂、チタン化合物、発泡剤、ラジカル発生剤、分解促進剤は、前記成形体B₁、B₂、B₃で用いたものと同じものが使用され、基層と表面層には必要な鉛系又は錫系安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。また、表面層の厚みは、前記成形体B₅の表面層の厚みと同様である。

【0114】この成形体B₆は、表面層が前記成形体B₅の表面層と同じ組成であるから、表面が良好な耐薬品性及び耐蝕性を有している。しかも、基層には前記成形

体B₂、B₃と同様に分解促進剤、ラジカル発生剤が含まれ、表面層には発泡剤が含まれるので、基層の塩化ビニル系樹脂の早期の分解で生じた腐食性ガスや煙が、表面層の発泡剤で生成された気泡により捕獲されて、炭化促進とガス捕獲がバランス良く行われる。従って、この成形体B₆は全体として優れた難燃性を有している。

【0115】尚、これらの複層構造の成形体B₅、B₆においても、前述の塩素捕獲化合物や無機質助剤を基層に2~30重量部含有させることが可能であり、その場合は難燃性が更に向上し、発煙量や耐食性ガス発生量が減少する。

【0116】これらの複層構造の成形体B₅、B₆は、チタン化合物、ラジカル発生剤、分解促進剤、塩素捕獲化合物、無機質助剤、その他の添加剤等を選択して配合した基層成形用の塩化ビニル系樹脂組成物と、チタン化合物、発泡剤、その他の添加剤等を配合した表面層成形用の塩化ビニル樹脂組成物を調製し、これらの組成物を多層押出成形、カレンダープレス、ラミネートその他の手段によって、所望の形状に積層成形して製造されるものであり、優れた難燃性に加えて表面の耐薬品性、耐蝕性が良好であるため、表面の耐薬品性等が要求される用途、例えば半導体製造装置の一部である洗浄槽などの材料として好適に用いられる。

【0117】尚、上記複層構造の難燃性塩化ビニル樹脂成形体B₅、B₆は、表面層にチタン化合物と発泡剤を含有させたものであるが、発泡剤に代えて他の難燃性付与成分である分解促進剤、ラジカル発生剤、架橋剤のいずれかを含有させてもよい。

【0118】次に、チタン化合物を含み、難燃性付与成分を含まない成形体Cについて説明する。

【0119】この成形体Cは、塩化ビニル系樹脂100重量部に対して、チタン酸カリウムを5~50重量部含有せしめた単層構造の成形体であり、この成形体Cにも、成形に必要な鉛系又は錫系安定剤、滑剤、加工助剤、着色剤などの各種添加剤が適量配合される。塩化ビニル系樹脂としては前述の各成形体に用いたものと同じものが使用される。

【0120】この成形体Cのように、チタン化合物であるチタン酸カリウムを5~50重量部含有させると、火災時にチタン酸カリウムが熱遮断作用と炭化促進作用を発揮するため、難燃性が向上し、煙や腐食性ガスの発生量が減少する。

【0121】チタン酸カリウムは、粒状のものや繊維状のもの等、どのような形状のものでも使用されるが、平均粒径が0.1~0.5μmの粒状のものは混練性が良く、また、繊維径が0.1~1μmで長さが5~30μmの繊維状のものは高強度で高剛性の成形体を得ることができる。

【0122】チタン酸カリウムの含有量は5~50重量部とすることが必要であって、5重量部未満では難燃性

を向上させることが難しくなり、50重量部より多量に含有させると、成形体Cの耐薬品性、強度、曲げ加工性などが低下する。チタン酸カリウムの更に好ましい含有量は8~30重量部である。

【0123】このような単層構造の成形体Cは、チタン酸カリウム、その他の添加剤等を選択して配合した塩化ビニル系樹脂組成物を、押出成形、カレンダープレス、射出成形、その他の公知の成形技術によって、平板その他の所望の形状に成形して得られるものであり、そのまま、或は、更に二次加工して、耐熱性が要求される各種用途に使用される。

【0124】次に、リン系難燃剤又は亜鉛化合物と、好ましくは難燃性付与成分のいずれかを含む透明な成形体Dについて説明する。この成形体Dの主な実施形態としては、塩素化度の高い塩化ビニル系樹脂を使用する単層構造の成形体D₁、D₂、塩素化度が普通の塩化ビニル系樹脂を使用する単層構造の成形体D₃、塩素化度の高い塩化ビニル系樹脂と塩素化度が普通の塩化ビニル系樹脂のいずれか一方又は双方を使用する積層構造の成形体D₄、D₅、D₆、D₇などを挙げることができる。

【0125】まず、塩素化度が略58~略73%と高い塩化ビニル系樹脂を用いる透明な成形体D₁は、該塩化ビニル系樹脂100重量部に対して、リン系難燃剤を0.5~15重量部、塩素化ポリエチレンを0.5~20重量部、錫系安定剤を0.5~7重量部含有させたものを基本組成とし、所望する場合には、更に難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくとも一種を0.0005~10重量部含有させたものである。

【0126】塩素化度が略58~略73%の塩化ビニル系樹脂としては、前述の成形体A₇の表面層に用いたものと同じもの、即ち、塩素化度が略58~略73%の後塩素化塩化ビニル樹脂や、この後塩素化塩化ビニル樹脂に一般の塩化ビニル樹脂、酢酸ビニル樹脂、アクリル樹脂、塩化ビニル-酢酸ビニル共重合樹脂等を混合した平均塩素化度が略58~略73%の混合樹脂などが使用される。このうち、後塩素化塩化ビニル樹脂のものが好ましく使用される。

【0127】塩素化度が略58~略73%と高い上記の塩化ビニル系樹脂は、塩素化度が略56%の一般の塩化ビニル樹脂に比べると、熱分解により多量の塩素ガスを発生して燃焼を遅らせるため、難燃性に優れた成形体を得るのに有利な材料樹脂である。難燃性の観点からは塩素化度が高い樹脂ほど有利だが、塩素化度が略73%より高い塩化ビニル系樹脂は製造が困難であり、熱安定性、成形性、曲げ加工性、耐薬品性、耐食性なども悪いので、原料樹脂として不適当である。

【0128】塩化ビニル系樹脂に含有させる上記のリン系難燃剤としては、含ハロゲンリン酸エステル、含ハロゲン縮合リン酸エステル、非ハロゲンリン酸エステル、

非ハロゲン縮合リン酸エステル、正リン酸エステル等の有機リン系のものが適しており、例えば、トリス(クロロエチル)ホスフェート、トリス(クロロプロピル)ホスフェート、トリス(ジクロロプロピル)ホスフェート、トリメチルホスフェート、トリフェニルホスフェート、トリクレジルホスフェート、クレジジフェニルホスフェート、2-エチルヘキシルジフェニルホスフェート等が好ましく使用される。

【0129】このような有機リン系難燃剤は、ハロゲン系難燃剤や酸化アンチモン等の難燃剤に比べて透明性に優れるため、透明な成形体D₁を得るのに有利であり、しかも、燃焼時には、この有機リン系難燃剤が熱分解してリン酸を生成し、該リン酸が塩化ビニル系樹脂の表面に残留して酸素移動を妨げると共に、表面の炭化を促進して燃焼を抑制するため、成形体D₁の難燃性を向上させることができる。また、この有機リン酸エステルは、内部滑剤或は外部滑剤としても作用するので、他的高级脂肪酸等の難燃性を付与しない滑剤を使用しなくてもよい利点がある。

【0130】なお、赤リンなどの無機リン系難燃剤も、透明性を損なわない範囲で使用可能である。

【0131】塩化ビニル系樹脂に含有させる上記の塩素化ポリエチレンは補強剤としても作用するもので、機械的強度を向上させ、成形体D₁に必要な実用強度を付与する。該塩素化ポリエチレンは、その塩素化度が25~45%のものが好適に使用される。かかる塩素化ポリエチレンを含有させると、熱分解により発生する塩素ガスが樹脂の燃焼を遅らせるため、成形体D₁の難燃性を向上させることができる。塩素化度が25%未満の塩素化ポリエチレンは、塩素ガスの発生量が少ないので難燃性の向上には不利であり、塩素化度が45%以上の塩素化ポリエチレンは、補強効果あまり向上しないという不都合があるので好ましくない。なお、補強剤としてアクリル系やMBS系のものも考えられるが、これらは難燃作用がないので好ましくない。

【0132】前記のリン系難燃剤は、塩化ビニル系樹脂100重量部に対して0.5~15重量部含有させる必要があり、塩素化ポリエチレンは0.5~20重量部含有させる必要がある。リン系難燃剤と塩素化ポリエチレンの含有量がいずれも0.5重量部未満の場合は、成形体D₁の難燃性を十分に向上させることが困難となる。一方、リン系難燃剤の含有量が15重量部より多くなると、透明性の低下を招くようになり、また、塩素化ポリエチレンの含有量が20重量部より多くなると、透明性が低下し、必要な全光線透過率が得られない。リン系難燃剤の好ましい含有量は2~10重量部、塩素化ポリエチレンのそれは3~15重量部である。

【0133】可塑剤や滑剤の配合は難燃性を弱め透明性を低下させるので、できるだけ配合しないようにすることが望ましく、できれば配合しないことが望ましい。し

かし、熱安定剤である錫系安定剤は配合しなければならない。錫系安定剤としては、ジブチル錫マレート系、ジブチル錫ラウレート系などの従来公知のものが全て使用可能であり、その含有量は塩化ビニル系樹脂100重量部に対して0.5~7重量部とする必要がある。0.5重量部未満では成形時の熱安定性が低下し、一方、7重量部より多く配合してもそれに見合った熱安定効果が得られないので無駄になる。尚、鉛系の安定剤は、透明な塩化ビニル系樹脂の成形体を得る場合には不適当である。

【0134】上記のような基本組成の透明な難燃性塩化ビニル系樹脂成形体D₁には、前述した難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を含有させて難燃性を一層高めたり、紫外線吸収剤を含有させて耐候性を高めてもよい。

【0135】上記の難燃性付与成分は、塩化ビニル系樹脂100重量部に対し0.0005~10重量部の割合で含有させることが必要であって、含有量が0.0005重量部より少なくなると、成形体D₁の難燃性を更に向上させることが難しくなり、一方、含有量を10重量部より多くしても、それに見合った難燃性向上効果が得られないので無駄となる。難燃性付与成分の個々の好ましい含有量は、発泡剤では0.05~10重量部、分解促進剤では0.0005~5重量部、ラジカル発生剤では0.0005~5重量部、架橋剤では0.005~5重量部である。

【0136】なお、上記組成物に顔料、染料等の着色剤や紫外線吸収剤等を、難燃性を阻害しない範囲で適量配合してもよい。

【0137】上述した基本組成の成形体D₁は、その厚さが5mmのときに、全光線透過率が50%以上、ヘイズ値が60%以下の透明な成形体となり、採光性や透視性が良好である。上記全光線透過率とヘイズ値の好ましい値は、それぞれ70%以上、30%以下である。そして、この基本組成の成形体D₁は、塩化ビニル系樹脂の塩素化度が高い上に、リン系難燃剤と塩素化ポリエチレンによって難燃性が高められるため、燃え難く発煙量も少ない。また、難燃性付与成分を更に含有させた成形体は難燃性が一層向上する。

【0138】塩素化度が略58~略73%と高い塩化ビニル系樹脂を用いるもう一つの透明な成形体D₂は、該塩化ビニル系樹脂100重量部に対して、リン系難燃剤又は塩素化ポリエチレンのいずれかを0.5~15重量部、錫系安定剤を0.5~7重量部、難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくとも一種を0.0005~10重量部含有させたものである。

【0139】塩素化度が略58~略73%の塩化ビニル系樹脂、リン系難燃剤、塩素化ポリエチレン、錫系安定

剤としては、前述の成形体D₁に用いたものと同じものが使用され、また、難燃性付与成分としては既述したものが使用される。また、その好ましい含有量も成形体D₁と同じである。

【0140】かかる成形体D₂は、厚さが5mmのときに、全光線透過率が40%以上、ヘイズ値が60%以下となり、採光性や透視性が良好なものであるが、好ましくは、全光線透過率が60%以上、ヘイズ値が30%以下となるように、各成分の含有量を上記の含有量の範囲内で調整するのがよい。

【0141】この成形体D₂のように、難燃性付与成分である発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくとも一種を必須成分として配合する場合は、該難燃性付与成分によって成形体D₂の難燃性が高められるので、前述の成形体D₁のようにリン系難燃剤と塩素化ポリエチレンの双方を含有させる必要がなくなり、リン系難燃剤又は塩素化ポリエチレンのどちらか一方を含有させるだけで、成形体D₂に優れた難燃性を付与することが可能となる。

【0142】リン系難燃剤又は塩素化ポリエチレンのいずれかの含有量を0.5重量部より少なくし、且つ、難燃性付与成分の含有量を0.0005重量部より少なくすると、成形体D₂の透明性は向上するけれども、成形体D₂の難燃性を顕著に向上させることは難しくなる。一方、リン系難燃剤又は塩素化ポリエチレンのいずれかの含有量を15重量部より多くし、且つ、難燃性付与成分の含有量を10重量部より多くしても、それに見合った難燃性向上効果が得られず、却って成形体D₂の透明性の大幅な低下を招くことになる。

【0143】尚、この成形体D₂においても、顔料、染料等の着色剤や紫外線吸収剤等を、難燃性を阻害しない範囲で適量配合することが可能である。

【0144】上記のような透明の難燃性塩化ビニル系樹脂成形体D₁、D₂は、塩素化度が略58~略73%の塩化ビニル系樹脂にリン系難燃剤及び塩素化ポリエチレンの双方と錫系安定剤とを配合した樹脂組成物、或は、塩素化度が略58~略73%の塩化ビニル系樹脂にリン系難燃剤又は塩素化ポリエチレンのいずれか一方と錫系安定剤と難燃性付与成分の少なくとも一種を配合した樹脂組成物を調製し、これらの樹脂組成物を溶融押出成形、カレンダープレス成形、射出成形、その他の公知の成形手段で、平板、パイプ、丸棒、溶接棒、アングル等の異形品など、所望の形状に成形することによって製造されるものであり、そのまま、或は、二次加工して各種の用途に使用される。尚、成形体D₁、D₂の厚さについては制限がなく、用途などを考慮して適宜決定すればよいが、通常、3~15mm程度の厚さにすると充分な実用強度を付与することができる。

【0145】次に、塩化ビニル系樹脂を用いる成形体D₃は、該塩化ビニル系樹脂100重量部に対し、亜鉛化

合物を金属亜鉛の量に換算して0.005~5重量部、錫系安定剤を0.5~7重量部含有せしめたものであり、その全光線透過率が40%以上、ヘイズ値が60%以下の透明な成形体である。かかる成形体D₃は、亜鉛化合物により塩化ビニル系樹脂の分解が促進されて炭化が早められるので、優れた難燃性を有する。全光線透過率とヘイズ値の好ましい範囲は、それぞれ60%以上、30%以下であり、このような全光線透過率とヘイズ値が得られるように亜鉛化合物や錫系安定剤の含有量を上記の範囲内で調整することが望ましい。

【0146】塩化ビニル系樹脂としては、塩素化度が56.4%の一般の塩化ビニル樹脂や、塩素化度が57~73%の後塩素化塩化ビニル樹脂や、これらの樹脂を混合して塩素化度を好みのものにした樹脂や、これらの塩化ビニル樹脂に酢酸ビニル樹脂、塩化ビニル-酢酸ビニル共重合樹脂等の一種又は二種を混合した樹脂が使用される。これらの樹脂のうち、塩素化度が略58~73%の塩化ビニル系樹脂を用いると、難燃性に優れた成形耐を得るのに好ましい。また、塩素化度が56.4%の塩化ビニル樹脂を用いると、塩素化度が58~73%の樹脂より耐薬品性に優れた成形体とすることができ、しかも、亜鉛化合物により炭化が早められ難燃性を付与できるので好ましく用いられる。

【0147】亜鉛化合物としては、前述の分解促進剤として使用されるステアリン酸亜鉛、ラウリン酸亜鉛、安息香酸亜鉛等が好適であり、このような亜鉛化合物を含有させると、燃焼時に亜鉛化合物の樹脂分解促進作用や金属亜鉛の良好な熱伝導性によって塩化ビニル系樹脂の炭化が促進されるため、難燃性に優れた成形体となる。亜鉛化合物の含有量が金属亜鉛の量に換算して0.005重量部より少なくなると、成形体に十分な難燃性を付与することが困難となり、一方、5重量部より多くなると、透明性が悪くなる。各亜鉛化合物の亜鉛含有率は、ステアリン酸亜鉛で10.5%、ラウリン酸亜鉛で14.0%、パラターシャリーブチル安息香酸亜鉛で14.5%であるので、金属亜鉛の量が上記範囲となるように各亜鉛化合物を含有させる。尚、亜鉛化合物は滑剤としても作用するので、他の不透明にしたり燃え易くする滑剤を減らしたり、使用しなくても済むようになる。

【0148】また、錫系安定剤としては、前述のジブチル錫マレート系、ジブチル錫ラウレート系などの従来公知のものが使用され、その含有量は前述の成形体D₁、D₂の場合と同様である。

【0149】尚、この成形体D₃には、上記の亜鉛化合物と錫系安定剤の他に、可塑剤や滑剤や加工助剤や着色剤や紫外線吸収剤などが適量配合される。

【0150】上記のような組成の難燃性塩化ビニル系樹脂成形体D₃には、難燃性付与成分である前述の発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を更に含有させて、難燃性を一層向上させ

てもよい。難燃性付与成分の含有量は、前述の成形体D₁、D₂の場合と同様である。

【0151】このような成形体D₃は、亜鉛化合物と錫系安定剤の他に、可塑剤、滑剤、加工助剤、必要に応じて難燃性付与成分などを適量配合した塩化ビニル系樹脂組成物を調製し、前述の成形体D₁、D₂の場合と同様に熔融押出成形、カレンダープレス成形、射出成形、その他の公知の成形手段で所望の形状に成形することによって製造されるものであり、そのまま、或は、二次加工して各種の用途に使用される。

【0152】以上説明した成形体D₁、D₂、D₃はいずれも単層構造のものであるが、例えば、基層の両面又は片面に表面層を形成した以下のような積層構造の成形体D₄、D₅、D₆、D₇としてもよい。

【0153】即ち、成形体D₄は、塩素化度が略58~略73%の塩化ビニル系樹脂100重量部に対し、リン系難燃剤を0.5~15重量部、塩素化ポリエチレンを0.5~20重量部、錫系安定剤を0.5~7重量部含有させると共に、必要に応じて難燃性付与成分の少なくとも一種を更に含有させたもので厚さ2~14mmの基層を形成し、表面層は、塩素化度が略56%の塩化ビニル系樹脂100重量部に対し、亜鉛化合物を金属亜鉛の量に換算して0.005~5重量部、錫系安定剤を0.5~7重量部含有させると共に、可塑剤や滑剤や加工助剤等と、必要に応じて難燃性付与成分の少なくとも一種を適量配合したもので厚さ0.4~2mmの層に形成したものである。

【0154】このような積層構造の成形体D₄は、表面層が耐薬品性、耐食性に優れるだけでなく、成形時の熱安定性が良好であり、しかも、厚み方向の熱分解差がなくなるため難燃性に優れたものとなる。

【0155】また、成形体D₅は、塩素化度が略58~略73%の透明な塩化ビニル系樹脂100重量部に対して、リン系難燃剤を0.5~15重量部、塩素化ポリエチレンを0.5~20重量部、錫系安定剤を0.5~7重量部含有させた基本組成に、更に前記の分解促進剤を0.0005~10重量部含有させたもので厚さ2~14mmの基層を形成し、該基本組成に更に発泡剤を0.0005~10重量部含有させたもので厚さ0.4~2mmの表面層を形成した成形体である。

【0156】このような成形体D₅は、発泡剤の成形体中に占める含有総量が少ないので透明性が良好であり、しかも、燃焼時には基層で分解して生じる煙や塩化水素ガスが表面層の発泡により生じた気泡に取り込まれるため、揮散するガス量が少なく優れた難燃性を発揮する。この場合、表面層の樹脂として、基層のものより塩素化度の低い樹脂、或は一般塩化ビニル樹脂を加えて見掛けの塩素化度を低下させた樹脂を使用することで、耐薬品性を向上させることができる。

【0157】また、成形体D₆は、塩素化度が略56%

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の一般の塩化ビニル系樹脂100重量部に対して、亜鉛化合物を金属亜鉛の量に換算して0.005~5重量部、錫系安定剤を0.5~7重量部含有させたもので厚さ2~14mmの基層を形成し、表面層は、前記の塩素化度が略56%の塩化ビニル系樹脂100重量部に対して、錫系安定剤を0.5~7重量部含有させると共に、発泡剤を0.0005~10重量部含有させたもので厚さ0.4~2mmの層に形成した成形体である。

【0158】このような成形体D₆の場合も、基層で生じるガスを表面層に生じる気泡で取り込むことによりガス発生量を減少させることができるので、優れた難燃性を発揮する。なお、基層や表面層には、可塑剤や加工助剤や紫外線吸収剤を適量配合してもよい。

【0159】また、成形体D₇は、塩素化度が略56%の一般の塩化ビニル系樹脂100重量部に対して、錫系安定剤を0.5~7重量部、発泡剤、分解促進剤、ラジカル発生剤、架橋剤の少なくともいずれか一種を0.0005~10重量部含有せしめたもので厚さ2~14mmの基層を形成し、表面層は、塩素化度が58~73%の塩化ビニル系樹脂100重量部に対して、リン系難燃剤及び/又は塩素化ポリエチレンを0.5~20重量部、錫系安定剤を0.5~7重量部含有せしめたもので厚さ0.4~2.0mmの層に形成した成形体である。

【0160】このような成形体D₇の場合、基層は発泡剤等により、表面層はリン系難燃剤等により、それぞれ難燃化されており、優れた難燃性を発揮する。

【0161】次に、本発明の更に具体的な実施例を説明する。

【0162】[実施例1~4]市販の塩素化度が略56%の塩化ビニル樹脂(U-PVC)100重量部に対して、鉛安定剤4重量部、滑剤2重量部、加工助剤4重量部を添加し、均一に混合して基本配合組成物(U-PVC使用)を調製した。この基本組成物110重量部に対し、発泡剤としてアゾジカルボンアミドを、架橋剤としてトリアジンチオールを、ラジカル発生剤としてジアミルパーオキシサイドを、分解促進剤としてラウリン酸亜鉛を、表1に示す割合で選択的に混合して4種類の樹脂組成物を調製し、これらの樹脂組成物でカレンダーシートを作製した後、プレスすることによって、組成が異なる4種類の単層構造の難燃性塩化ビニル樹脂板(厚さ5mm)を得た。

【0163】そして、800℃に加熱した電気炉に上記4種類の樹脂板(50×50×5mm)を入れ、着火の有無、着火するまでの時間を調べて難燃性テストを行った。その結果を下記の表1に示す。

【0164】また、上記の各樹脂板について、その機械的強度と耐薬品性を調べ、その結果を表1に併せて示した。この機械的強度はJIS K6745に基づいてアイゾット衝撃強さ、引張り強度、伸び率を測定したものであり、耐薬品性は97%硫酸、35%硫酸、28%ア

ンモニア水の各薬液に23℃で7日間浸漬した後の外観変色を観察し、◎を変色なし、○を僅かに変色あり、△を変色あり、×を著しい変色あり、として表示したものである。

【0165】[実施例5]塩素化度が略64%の後塩素化塩化ビニル樹脂(C-PVC)100重量部に対して、鉛安定剤4重量部、滑剤2重量部、加工助剤4重量部を添加し、均一に混合して基本配合組成物(C-PVC使用)を調製した。この基本配合組成物110重量部に対し、分解促進剤としてラウリン酸亜鉛を0.5重量部混合して樹脂組成物を調製し、この樹脂組成物を用いてカレンダーシートを作製した後、プレスすることによって単層構造の難燃性塩化ビニル樹脂板(厚さ5mm)を得た。

【0166】そして、この樹脂板について、実施例1~4と同様に難燃性テストを行うと共に、その機械的強度と耐薬品性を調べた。その結果を下記の表1に示す。

【0167】[実施例6]実施例1~4で調製した基本配合組成物(U-PVC使用)110重量部に対し、ラジカル発生剤としてジアミルパーオキシサイドを0.5重量部配合して基層用組成物を調製すると共に、実施例1~4で調製した基本配合組成物110重量部に対し、発泡剤としてアゾジカルボンアミドを0.5重量部配合して表面層用組成物を調製した。

【0168】そして、これらの基層用組成物及び表面層用組成物のカレンダーシートをそれぞれ作製し、重ね合わせてプレスすることにより、厚さ4mmの基層の両面に厚さ0.5mmの表面層を有する三層構造の難燃性塩化ビニル樹脂板(全体の厚さ5mm)を得た。

【0169】この樹脂板について、実施例1~5と同様に難燃性テストを行うと共に、その機械的強度と耐薬品性を調べた。その結果を表1に示す。

【0170】[実施例7]実施例1~4で調製した基本配合組成物(U-PVC使用)110重量部に対し、分解促進剤としてラウリン酸亜鉛を0.5重量部配合して基層用組成物を調製すると共に、実施例1~4で調製した基本配合組成物110重量部に対し、発泡剤としてアゾジカルボンアミドを0.3重量部、分解促進剤としてラウリン酸亜鉛を0.2重量部配合して表面層用組成物を調製した。

【0171】そして、これらの基層用組成物及び表面層用組成物のカレンダーシートをそれぞれ作製し、重ね合わせてプレスすることにより、厚さ4mmの基層の両面に厚さ0.5mmの表面層を有する三層構造の難燃性塩化ビニル樹脂板(全体の厚さ5mm)を得た。

【0172】この樹脂板について、実施例1~5と同様に難燃性テストを行うと共に、その機械的強度と耐薬品性を調べた。その結果を表1に示す。

【0173】

【表1】

		実施例1	実施例2	実施例3	実施例4	実施例5	実施例6		実施例7	
							表面層	基層	表面層	基層
組成 (重量部)	基本配合組成物 (U-PVC使用)	110	110	110	110	—	110	110	110	110
	基本配合組成物 (C-PVC使用)		—	—	—	110	—	—	—	—
	発泡剤 (アゾジカルボンアミド)	0.1	—	—	—	—	0.5	—	0.3	—
	架橋剤 (トリアジンチオール)	—	0.7	—	—	—	—	—	—	—
	ラジカル発生剤 (ジアミルパーオキサイド)	—	—	0.7	—	—	—	0.5	—	—
	分解促進剤 (ラウリン酸亜鉛)	0.5	—	—	0.7	0.5	—	—	0.2	0.5
強度	アイソット衝撃強さ (KJ/m ²)	6.0	6.0	6.0	6.0	5.4	6.0		6.0	
	引張り強度 (N/mm ²)	50	50	50	50	50	50		50	
	伸び率(%)	160	150	150	150	100	140		160	
難燃性 テスト	着火の有無	無	無	無	無	無	無		無	
	着火時間(秒)	—	—	—	—	—	—		—	
耐薬品 性	97% 硫酸	◎	○	○	○	◎	◎		◎	
	35% 硫酸	◎	○	○	○	◎	◎		◎	
	28% アンモニア水	◎	◎	◎	◎	◎	◎		◎	

【0174】この表1を見れば、難燃性付与成分の少なくとも一種を含有させた実施例1～7の難燃性塩化ビニル樹脂板はいずれも着火せず、良好な難燃性を有することが分かる。そして、塩素化度が略56%の塩化ビニル樹脂(U-PVC)を使用した実施例1, 2, 3, 4, 6, 7の樹脂板は、衝撃強さ、引張り強度、伸びなども充分である。これに対し、塩素化度が略64%の後塩素化塩化ビニル樹脂(C-PVC)を使用した実施例5の樹脂板は、衝撃強さ、引張り強度、伸び等が他の実施例の樹脂板に比べるとやや劣っているが、それでも充分なレベルにあり、また、耐薬品性に弱い高塩素化度の後塩素化塩化ビニル樹脂を使用しているにも拘らず、分解促進剤としてのラウリン酸亜鉛を0.5重量部と少量含有させることによって優れた耐薬品性を具備している。また、難燃性付与成分の含有量が0.5重量部と少ない実施例6, 7の三層構造の樹脂板も、優れた耐薬品性を有している。

【0175】[実施例8～12] 実施例1～4で調製した基本配合組成物(U-PVC使用)110重量部に対し、チタン化合物として、実施例8～11では表面がアルミナで被覆された酸化チタン(平均粒径: 略0.2μm以下)、実施例12では繊維状のチタン酸カリウムを、また、発泡剤としてアゾジカルボンアミドを、架橋剤としてトリアジンチオールを、ラジカル発生剤としてジアミルパーオキサイドを、分解促進剤としてラウリン*50

*酸亜鉛を、それぞれ下記の表2に示す割合で選択的に混合して5種類の樹脂組成物を調製した。そして、これらの樹脂組成物でカレンダーシートを作製した後、プレスすることによって、組成が異なる5種類の単層構造の難燃性塩化ビニル樹脂板(厚さ5mm)を得た。

【0176】これらの樹脂板について、実施例1～4と同様に難燃性テストを行うと共に、その機械的強度と耐薬品性を調べた。その結果を下記の表2に示す。

【0177】[実施例13] 実施例1～4で調製した基本配合組成物(U-PVC使用)110重量部に対し、チタン化合物として酸化チタンを30重量部配合して基層用組成物を調製した。また、実施例1～4で調製した基本配合組成物(U-PVC使用)110重量部に対し、チタン化合物として酸化チタンを5重量部、発泡剤としてアゾジカルボンアミドを0.5重量部配合して、表面層用組成物を調製した。

【0178】そして、これらの基層用組成物及び表面層用組成物のカレンダーシートをそれぞれ作製し、重ね合わせてプレスすることにより、厚さ4mmの基層の両面に厚さ0.5mmの表面層を有する三層構造の難燃性塩化ビニル樹脂板(全体の厚さ5mm)を得た。

【0179】この樹脂板について、実施例1～4と同様に難燃性テストを行うと共に、その機械的強度と耐薬品性を調べた。その結果を下記の表2に示す。

【0180】[実施例14] 実施例1～4で調製した基

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本配合組成物（U-PVC使用）110重量部に対し、チタン化合物として酸化チタンを30重量部、分解促進剤としてラウリン酸亜鉛を0.5重量部配合して基層用組成物を調製した。また、実施例1～4で調製した基本配合組成物（U-PVC使用）110重量部に対し、チタン化合物として酸化チタンを5重量部、発泡剤としてアゾジカルボンアミドを0.5重量部配合して表面層用組成物を調製した。

【0181】そして、これらの基層用組成物及び表面層用組成物のカレンダーシートをそれぞれ作製し、重ね合

わせてプレスすることにより、厚さ4mmの基層の両面に厚さ0.5mmの表面層を有する三層構造の難燃性塩化ビニル樹脂板（全体の厚さ5mm）を得た。

【0182】この樹脂板について、実施例1～4と同様に難燃性テストを行うと共に、その機械的強度と耐薬品

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性を調べた。その結果を下記の表2に示す。

【0183】[比較例1～2] 実施例1～4で調製した基本配合組成物（U-PVC使用）110重量部に対し、チタン化合物として酸化チタンを4重量部混合した樹脂組成物（比較例1）と、酸化チタンを55重量部混合した樹脂組成物（比較例2）を調製し、実施例8～12と同様にカレンダーシートを作製した後、プレスすることによって、2種類の比較用の単層構造の難燃性塩化ビニル樹脂板（厚さ5mm）を得た。

10 【0184】そして、これらの樹脂板について、実施例1～4と同様に難燃性テストを行うと共に、その機械的強度と耐薬品性を調べた。その結果を下記の表2に示す。

【0185】

【表2】

組 成 (重 量 部)	実施例 8	実施例 9	実施例 10	実施例 11	実施例 12	実施例 13		実施例 14		比較例 1	比較例 2
						表面層	基層	表面層	基層		
基本配合組成物 (U-PVC使用)	110	110	110	110	110	110	110	110	110	110	110
チタン化合物 (酸化チタン他)	25	25	25	25	18	5	30	5	30	4	55
発泡剤 (アジカルポリアミド)	0.5	—	—	—	—	0.5	—	0.5	—	—	—
架橋剤 (Nアジチオール)	—	0.5	—	—	—	—	—	—	—	—	—
ラジカル発生剤 (シアミルパーオキサイド)	—	—	0.5	—	—	—	—	—	—	—	—
分解促進剤 (ラウリン酸)	—	—	—	0.5	0.5	—	—	—	—	0.5	0.5
アイソット衝撃強さ (KJ/m ²)	6.5	6.5	6.5	6.5	7.0	6.5		6.5		6.0	3.0
引張り強度 (N/mm ²)	48	48	48	48	55	50		50		56	58
伸び率 (%)	100	100	100	100	130	110		110		180	10
難燃性	無	無	無	無	無	無		無		有	無
着火時間(秒)	—	—	—	—	—	—		—		90	—
97%硫酸	△	△	△	△	△	◎		◎		◎	×
35%硫酸	○	○	○	○	○	◎		◎		◎	×
28%アンモニア水	◎	◎	◎	◎	◎	◎		◎		◎	△

注) 実施例12で使用了したチタン化合物はチタン酸カリウムである。

【0186】この表2を見れば、実施例8～14の難燃性塩化ビニル樹脂板はいずれも着火せず、良好な難燃性を有しており、衝撃強さ、引張り強度、伸びなども充分である。特に、チタン化合物の含有量が少ない表面層を備えた実施例13、14の樹脂板は、耐薬品性にも優れているし、繊維状のチタン酸カリウムを用いた実施例12の樹脂板は、含有量が少なくても機械的強度に優れていることが分かる。

【0187】これに対し、チタン化合物の含有量が多過ぎる比較例2の樹脂板は、難燃性に優れるけれども耐薬品性に劣っており、衝撃強さや伸びも劣っている。また、チタン化合物の含有量が少な過ぎる比較例1の樹脂板は、強度や耐薬品性が良いけれども、90秒で着火が*50

*見られ、難燃性に劣っていることが分かる。

【0188】[実施例15～18] 塩素化度が略64%の後塩素化塩化ビニル樹脂(C-PVC)100重量部に対し、ジブチル錫マレート系の熱安定剤を4重量部、滑剤としてステアリン酸を1重量部、加工助剤を2重量部、MBS系補強剤を5重量部混合して、透明成形体用の基本配合組成物(C-PVC使用)を調製した。

【0189】そして、この基本配合組成物(C-PVC使用)112重量部に対し、分解促進剤としてステアリン酸亜鉛を、発泡剤としてヒドラジド化合物を、架橋剤としてトリアジンチオールを、ラジカル発生剤としてジアミルパーオキサイドを、下記の表3に示す割合で選択的に混合して4種類の樹脂組成物を調製し、これらの樹

脂組成物を用いて厚さ0.5mmのカレンダーシートを作製した後、該カレンダーシートを10枚重ねてプレスすることにより、組成が異なる4種類の単層構造の透明な難燃性塩化ビニル樹脂板（厚さ5mm）を得た。

【0190】これらの透明な樹脂板について、JISK-7105に基づいて全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、実施例1～4と同様に難燃性テストを行った。その結果を下記の表3に示す。

【0191】〔実施例19～22〕塩素化度が略56%の一般の塩化ビニル樹脂（U-PVC）100重量部に対し、ジブチル錫マレート系の熱安定剤を4重量部、滑剤としてステアリン酸を1重量部、加工助剤を2重量部、MBS系補強剤を5重量部混合して、透明成形体用の基本配合組成物（U-PVC使用）を調製した。

【0192】そして、この基本配合組成物（U-PVC使用）112重量部に対し、分解促進剤としてステアリン酸亜鉛を、発泡剤としてヒドラジド化合物を、架橋剤としてトリアジンチオールを、ラジカル発生剤としてジアミルパーオキサイドを、下記の表3に示す割合で選択的に混合して4種類の樹脂組成物を調製し、これらの樹脂組成物を用いて厚さ0.5mmのカレンダーシートを作製した後、該カレンダーシートを10枚重ねてプレスすることにより、組成が異なる4種類の単層構造の透明

な難燃性塩化ビニル樹脂板（厚さ5mm）を得た。

【0193】これらの透明な樹脂板について、実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表3に示す。

【0194】〔実施例23〕実施例19～22で調製した基本配合組成物（U-PVC使用）112重量部に対し、分解促進剤としてステアリン酸亜鉛を0.7重量部配合して基層用組成物を調製した。また、実施例15～18で調製した基本配合組成物（C-PVC使用）112重量部に対し、分解促進剤としてステアリン酸亜鉛を0.3重量部、発泡剤としてヒドラジド化合物を0.1重量部配合して表面層用組成物を調製した。

【0195】そして、これらの基層用組成物及び表面層用組成物のカレンダーシートをそれぞれ作製し、重ね合わせてプレスすることにより、厚さ4mmの基層の両面に厚さ0.5mmの表面層を有する三層構造の透明な難燃性塩化ビニル樹脂板（全体の厚さ5mm）を得た。

【0196】この透明な樹脂板について、実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表3に示す。

【0197】

【表3】

	実施例 15	実施例 16	実施例 17	実施例 18	実施例 19	実施例 20	実施例 21	実施例 22	実施例 23	
									表面層	基層
組成 (重量部)										
基本配合組成物 (C-PVC使用) (塩素化度 54%)	112	112	112	112	—	—	—	—	112	—
基本配合組成物 (U-PVC使用) (塩素化度 56%)	—	—	—	—	112	112	112	112	—	112
分解促進剤 (ステアリン酸亜鉛)	0.5	—	—	0.3	0.7	—	—	0.5	0.3	0.7
発泡剤 (ヒドランジド化合物)	—	—	—	0.1	—	—	—	0.1	0.1	—
架橋剤 (トリアジンチオール)	—	0.5	—	—	—	0.7	—	—	—	—
ラジカル発生剤 (ジアルキルパーオキシド)	—	—	0.5	—	—	—	0.7	—	—	—
難燃性デスト	難燃の有無	難燃	難燃	難燃	難燃	難燃	難燃	難燃	難燃	難燃
	着火時間 (秒)	—	—	—	—	—	—	—	—	—
透明性	全光線透過率 (%)	76.8	76.9	75.6	72.4	84.4	83.5	80.1	82.2	—
	拡散光線透過率 (%)	7.3	7.4	7.2	15.3	5.2	5.3	8.8	6.8	—
	平行光線透過率 (%)	69.5	69.5	68.4	57.1	79.2	78.2	71.3	75.4	—
	ヘイズ値 (%)	9.5	9.6	9.5	21.1	6.2	6.3	11.0	8.3	—

【0198】この表3を見ると、実施例15～23の透明な樹脂板はいずれも着火せず、各樹脂板に含有される難燃性付与成分の働きによって良好な難燃性を発揮することが分かる。そして、塩素化度が略56%の通常の塩化ビニル樹脂 (U-PVC) を使用した実施例19～22の単層構造の樹脂板や、該通常の塩化ビニル樹脂 (U-PVC) を基層に使用した実施例23の三層構造の樹脂板は、全光線透過率が80%以上、ヘイズ値が11%以下であり、透明性に優れていることが分かる。これに対し、本来、透明性があまり良くない高塩素化度の後塩素化塩化ビニル (C-PVC) を使用した実施例15～18の透明な樹脂板は、通常の塩化ビニル樹脂 (U-PVC) *50

*VC) を使用した実施例19～23の樹脂板に比べると透明性がやや劣るとは言うものの、それでも全光線透過率が72%以上、ヘイズ値が22%未満であり、良好な透明性を有することが分かる。

【0199】[実施例24] 塩素化度が略64%の後塩素化塩化ビニル樹脂 (C-PVC) 100重量部に対し、リン系難燃剤としてトリクレジルホスフェートを5.0重量部、塩素化ポリエチレンを7.0重量部、ジブチル錫マレート系の熱安定剤を4.0重量部配合して樹脂組成物を調製した。そして、この樹脂組成物を用いて厚さ0.5mmのカレンダーシートを作製し、このカレンダーシートを10枚重ねてプレスすることにより、

厚さ5mmの透明な難燃性塩化ビニル樹脂板を製造した。

【0200】この透明な樹脂板について、実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0201】〔実施例25〕実施例24で調製した樹脂組成物に、分解促進剤としてステアリン酸亜鉛を更に0.2重量部配合し、これを用いて実施例24と同様に厚さ5mmの透明な難燃性塩化ビニル樹脂板を製造した。

【0202】そして、この透明な樹脂板について実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0203】〔実施例26〕実施例24で調製した樹脂組成物に、発泡剤としてヒドラジド化合物を更に0.3重量部配合し、これを用いて実施例24と同様に厚さ5mmの透明な難燃性塩化ビニル樹脂板を製造した。

【0204】そして、この透明な樹脂板について実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0205】〔実施例27〕実施例25で調製した樹脂組成物を用いて作製したカレンダーシートを6枚重ねると共に、その上下両面に、実施例26の樹脂組成物で作製したカレンダーシートを2枚ずつ重ねてプレスすることにより、厚さ3mmの芯層の上下両面に厚さ1mmの表面層を積層一体化した三層構造の透明な難燃性塩化ビニル樹脂板（全体の厚さ5mm）を製造した。

【0206】この透明な樹脂板について、実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0207】〔実施例28〕塩素化度が56.4%の一般の塩化ビニル樹脂（U-PVC）100重量部に対し、亜鉛化合物としてステアリン酸亜鉛を0.2重量部（金属亜鉛の量に換算すると0.02重量部）、ジブチル錫マレート系の安定剤を4.0重量部、滑剤としてステアリン酸を0.5重量部、可塑剤としてDOPを1.0重量部配合して樹脂組成物を調製した。

【0208】そして、この樹脂組成物を用いて、厚さ

0.5mmのカレンダーシートを作製し、このカレンダーシートを10枚重ねてプレスすることにより、厚さ5mmの単層構造の透明な難燃性塩化ビニル樹脂板を製造した。

【0209】この透明な樹脂板について、実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0210】〔実施例29〕塩素化度が略64%の後塩素化塩化ビニル樹脂（C-PVC）100重量部に対し、リン系難燃剤としてトリクレジルホスフェートを7.0重量部、ジブチル錫マレート系の熱安定剤を4.0重量部、発泡剤としてヒドラジド化合物を0.3重量部配合して樹脂組成物を調製した。そして、この樹脂組成物を用いて厚さ0.5mmのカレンダーシートを作製し、このカレンダーシートを10枚重ねてプレスすることにより、厚さ5mmの透明な難燃性塩化ビニル樹脂板を製造した。

【0211】この透明な樹脂板について、実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0212】〔比較例3〕塩素化度が略64%の後塩素化塩化ビニル樹脂（C-PVC）100重量部に対し、ジブチル錫マレート系の安定剤を4.0重量部、滑剤としてステアリン酸を0.5重量部、アクリル系加工助剤を1.5重量部、MBS系補強剤を5.5重量部配合して樹脂組成物を調製した。

【0213】そして、この組成物を用いて実施例24と同様に厚さ5mmの透明な塩化ビニル樹脂板を製造し、その全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定すると共に、難燃性テストを行った。その結果を下記の表4に示す。

【0214】〔比較例4〕ステアリン酸亜鉛を省略した以外は実施例28と同様にして樹脂組成物を調製し、厚さ5mmの透明な塩化ビニル樹脂板を製造した。

【0215】そして、この樹脂板について実施例15～18と同様に全光線透過率、拡散光線透過率、平行光線透過率、ヘイズ値を測定し、更に、難燃性テストを行った。その結果を下記の表4に示す。

【0216】

【表4】

	実施例 24	実施例 25	実施例 26	実施例 27		実施例 28	実施例 29	比較例 3	比較例 4
				表面層	基層				
組成 (重量部)	C-PVC (塩素化度 64%)	100	100	100	100	—	100	100	—
	一般PVC (塩素化度 56%)	—	—	—	—	100	—	—	100
	ジブチル錫マレート系安定剤	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	ステアリン酸	—	—	—	—	0.5	—	0.5	0.5
	DOP	—	—	—	—	1.0	—	—	1.0
	アクリル系加工助剤	—	—	—	—	—	—	1.5	—
	MBS系増強剤	—	—	—	—	—	—	5.5	—
	塩素化ポリエチレン	7.0	7.0	7.0	7.0	—	—	—	—
	リン系難燃剤 (トリクレジル ホスフェート)	5.0	5.0	5.0	5.0	—	7.0	—	—
	分解促進剤 (ステアリン酸亜鉛)	—	0.2	—	—	0.2	—	—	—
難燃性テスト	発泡剤 (ヒドランジド化合物)	—	—	0.3	—	—	0.3	—	—
	着火の有無	無	無	無	無	無	無	有	有
	着火時間 (秒)	—	—	—	—	—	—	20	16
	全光線透過率 (%)	84.9	82.0	70.1	78.0	85.1	75.2	77.6	86.4
透 明 性	拡散光線透過率 (%)	5.0	7.6	38.2	18.0	4.8	36.3	7.4	1.6
	平行光線透過率 (%)	79.9	74.4	31.9	60.0	80.3	38.9	70.2	84.8
	ヘイズ値 (%)	5.9	9.3	54.5	23.1	5.6	48.3	9.5	1.9

【0217】表4の実施例24～27と比較例3を対比すれば、実施例24～27の樹脂板は塩素化ポリエチレン、リン系難燃剤、分解促進剤、発泡剤等の働きによって優れた難燃性を発揮し、難燃性テストにおいていずれも着火しないという結果が得られたのに対し、上記の塩素化ポリエチレン、リン系難燃剤、分解促進剤、発泡剤等を含まない比較例3の樹脂板は、実施例24～27と同じ塩素化度の高い後塩素化塩化ビニル樹脂 (C-PVC) を使用しているにも拘らず難燃性に劣っており、20秒で着火するという結果が得られた。これにより、塩素化ポリエチレン、リン系難燃剤、分解促進剤、発泡剤* 50

40* 等が難燃性の付与に有効であることが裏付けられた。

【0218】また、難燃性付与剤である発泡剤を配合した実施例29の樹脂板は、塩素化ポリエチレンを省略してリン系難燃剤を配合しただけでも優れた難燃性を有し、着火がみられなかった。これにより、難燃性付与剤が配合されている場合は、塩素化ポリエチレン又はリン系難燃剤のいずれか一方を省略できることが分かる。

【0219】また、実施例28の樹脂板は、後塩素化塩化ビニル樹脂よりも難燃性が低い一般の塩化ビニル樹脂 (U-PVC) を使用しているにも拘らず、亜鉛化合物としてステアリン酸亜鉛を含むため難燃性が向上し、難

燃性テストに於いて着火しないという結果が得られたのに対し、比較例4の樹脂板のようにステアリン酸亜鉛を含まない一般の塩化ビニル樹脂からなる樹脂板は難燃性に劣っており、比較例3の樹脂板よりも更に短時間で着火するという結果であった。

【0220】また、実施例24～29の樹脂板はいずれも全光線透過率が70%以上、ヘイズ値が60%以下であって、透明性を有するものであるが、実施例26、29の樹脂板のように発泡剤を含むものはヘイズ値が上昇するので、発泡剤を使用する場合は、実施例27のよう

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に表面層に発泡剤を含有させてヘイズ値の上昇を抑えるようにする方が望ましいことが判る。

【0221】

【発明の効果】本発明の難燃性塩化ビニル系樹脂成形体は、単層構造のものも複層構造のものも難燃性が顕著に向上し、発煙量やガス発生量も減少するといった効果を奏し、透明な成形体は透明性が良好である。しかも、本発明の成形体は充分な実用強度を有し、耐薬品性や耐蝕性の低下が殆どなく、特に、複層構造のものは成形体表面の耐薬品性や耐蝕性が良好であり、耐薬品性及び難燃性が要求される各種の用途、なかでも半導体製造装置等の工業用材料として好適に使用できるといった効果を奏する。

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